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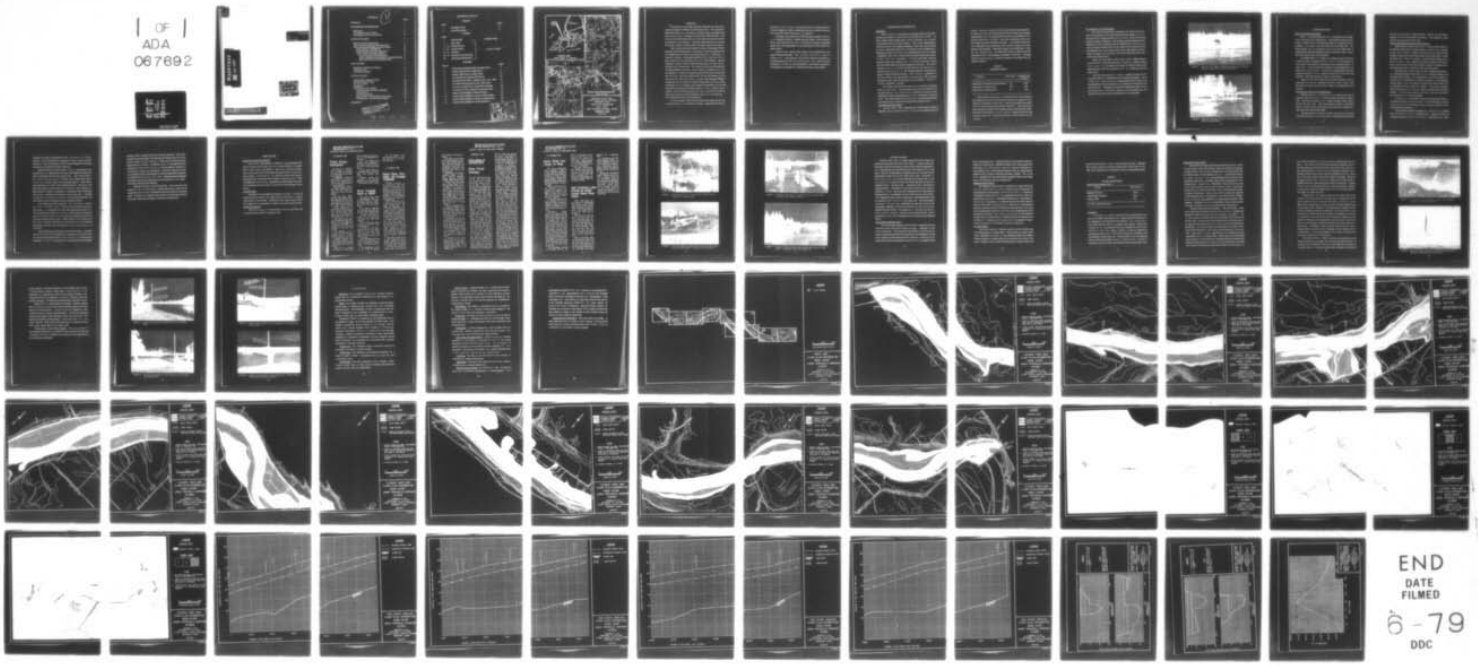

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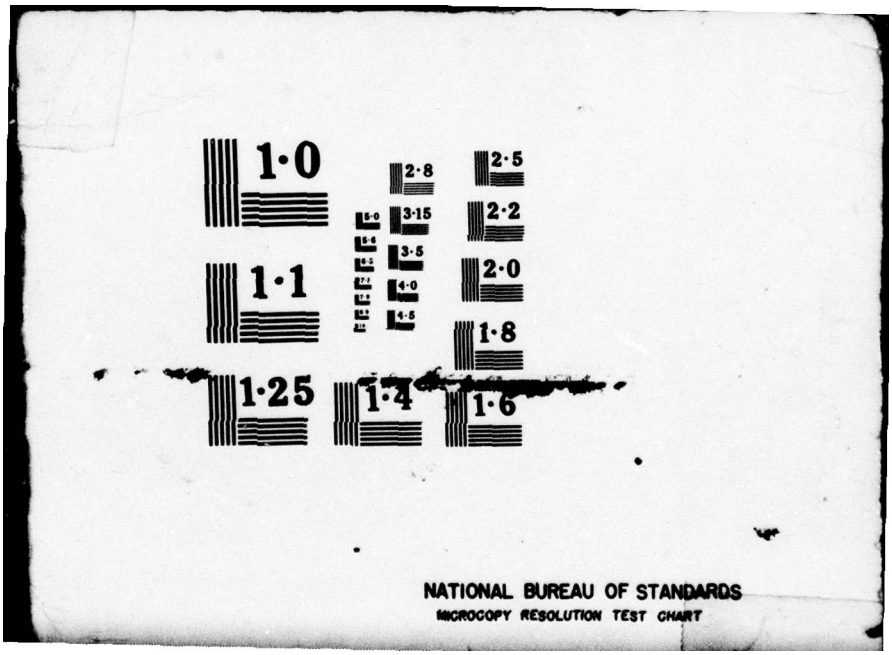
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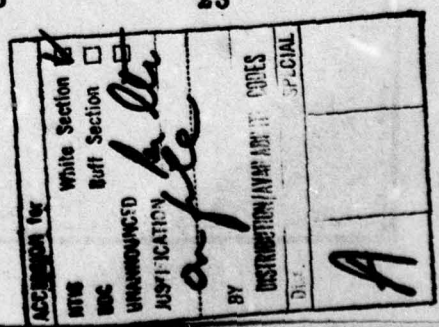
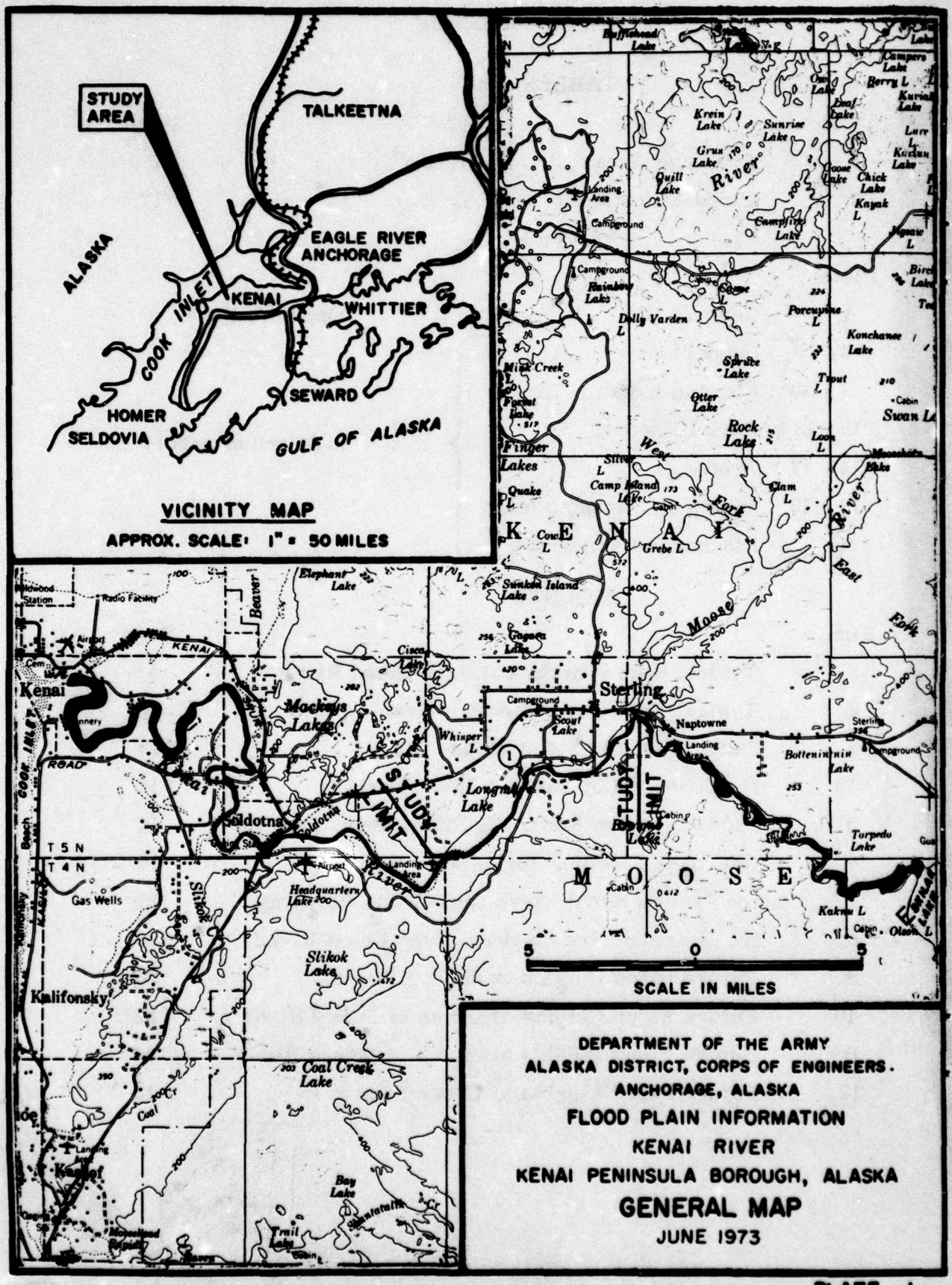




DEPARTMENT OF THE ARMY
ALASKA DISTRICT, CORPS OF ENGINEERS.
ANCHORAGE, ALASKA

FLOOD PLAIN INFORMATION
KENAI RIVER
KENAI PENINSULA BOROUGH, ALASKA
GENERAL MAP
JUNE 1973

PLATE 1

PREFACE

The portion of the Kenai Peninsula Borough covered by this report is subject to flooding from the Kenai River. The properties along this stream are primarily residential and recreational and were moderately damaged by the floods of 1964 and 1969. The areas in the flood plain which are now under pressure for future development are extensive. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding along Kenai River and identifies those areas that are subject to possible future floods. Special emphasis is given to these floods through maps, photographs, profiles and cross sections. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of loss and damage. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments, including flood proofing, which might be embodied in an overall Flood Plain Management (FPM) program. Other FPM program studies--those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings--would also profit from this information.

At the request of the Kenai Peninsula Borough and with the endorsement of the State of Alaska, Department of Natural

Resources, this report was prepared by the Alaska District, Corps of Engineers under continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of the National Weather Service, U. S. Geological Survey, Alaska Disaster Office, The Cheechako News, The Cook Inlet Courier and private citizens in supplying useful data and photographs for the preparation of this report are appreciated.

Additional copies of this report can be obtained from the Kenai Peninsula Brough. The Alaska District, Corps of Engineers, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented, as well as planning guidance and further assistance, including the development of additional technical information.

BACKGROUND INFORMATION

Settlement

The history of the Kenai area begins with the arrival of Russian fur traders on the bluff of the Kasiloff River in 1786. In 1791, another large trading post, Fort St. Nicholas, was erected at the present site of the city of Kenai. Prior to the establishment of the Russian fur trading companies, there were two principal groups of Indians in the area, the Kinnats and the Athabascans. During the years following the establishment of the fur trading companies, there were many bloody uprisings between the Indian tribes and the fur traders. It was not until 1867, when the Russian American Company was in control of the entire region, that the United States purchased Alaska from Russia. The city of Soldotna, which is 7 miles downstream from the study area, is located at the junction of the Sterling Highway and Kenai Spur Road, 11 miles southeast of Kenai. The village, established in the late 1930's, was named after a local stream, which probably derived its name from the Russian word for soldier - "soldat", or from "tseldatna", an herb.

The lands covered by this report are primarily residential and recreational. In recent years, due to the economic boom brought about by the discovery of nearby oil and gas fields, additional housing development has been taking place along the river. The future outlook is for greatly increased residential, recreational and commercial development along the river.

The Stream and Its Valley

Kenai River, with a drainage area of 2010 square miles at Soldotna, has its origin in Kenai Lake in the Chugach National

Forest. From the lake, the river flows westerly approximately 75 miles through the Kenai National Moose Range and privately owned lands near the communities of Sterling and Soldotna to its outlet in Cook Inlet at Kenai. The entire watershed of the river lies within the Kenai Peninsula Borough. The easterly portion of the watershed is predominantly steep mountain slopes with many glaciers and icefields. Elevations range to over 6000 feet. West of the mountains, the watershed includes rolling land with numerous lakes and muskegs extending to Cook Inlet. Drainage areas contributing to runoff at locations in the study area are shown in Table I.

TABLE I

DRAINAGE AREAS

Location	River Mile	Drainage Area Sq. Mi.
Kenai River at Moose Range Boundary	28	1930
Kenai River at Funny River	30.5	1905
Kenai River at Moose River	36	1748

The climate of the area is characterized by cool summers and moderate winters with temperature extremes ranging from 89 degrees to 48 degrees below zero. Annual precipitation averages over 19" at Kenai and annual snowfall about 68". Most of the rain falls during the middle of the summer season with sporadic rainfall early in the spring. A dry early summer and a wet late summer with poor rainfall distribution is characteristic of this climate.

Development in the Flood Plain

The portion of Kenai River included in the study commences where the boundary of the Kenai National Moose Range crosses the Kenai River approximately seven miles above the Sterling Highway Bridge at Soldotna, and extends upstream approximately eight miles to the confluence with the Moose River at Sterling. The flood plain of Kenai River in the study area is narrow and the development that now exists in the area is only minor in nature. There is ample high ground on each side of the river which provides safe building sites.

There are no bridges or other man-made obstructions in the Kenai River within the study area. However, a timber bridge does exist at the Funny River Road crossing of Funny River approximately 1,000 feet upstream from its confluence with the Kenai River.

The flood plain of Kenai River within the study area is occupied mainly by residential and recreational buildings. There is also some agricultural development and one commercial establishment which is situated at the confluence of the Kenai and Moose Rivers. Although the present development is only minor, the Kenai area is growing rapidly as a recreational area, and therefore greatly increased development can be expected.

FIGURE 1 - Typical of the many low-lying recreational structures along the Kenai River in the study area.

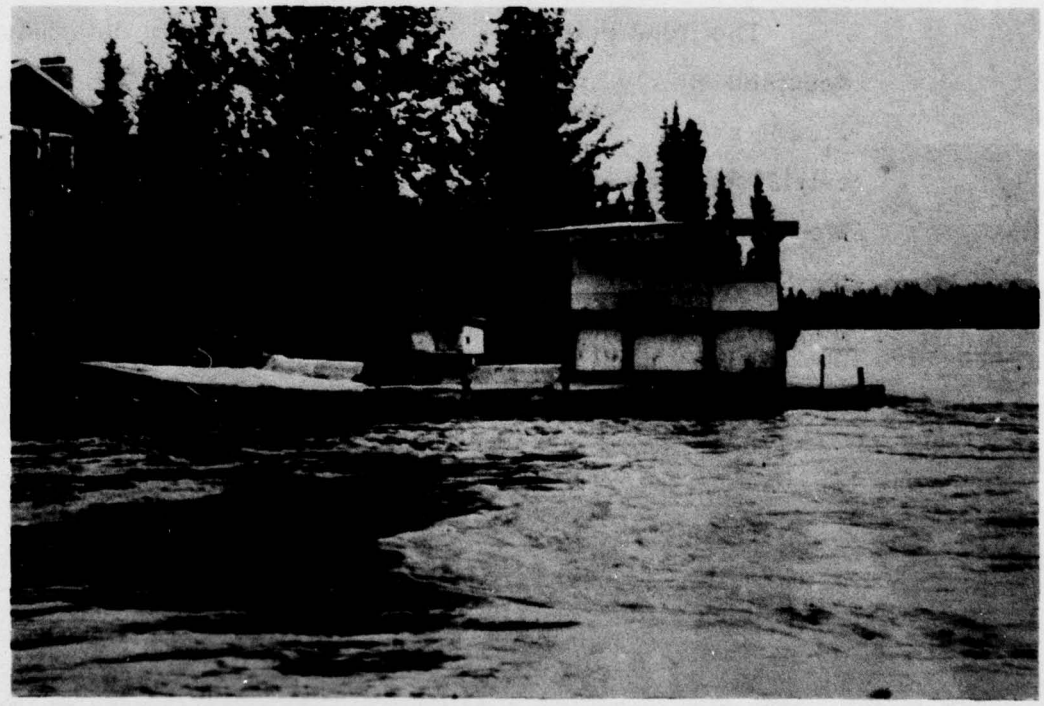


FIGURE 2 - Typical of the many docks or boat landings jutting out into the Kenai River.

FLOOD SITUATION

Sources of Data and Records

The U. S. Geological Survey has maintained stream gages at two locations on the Kenai River. One station is located at the outlet of Kenai Lake at the Sterling Highway crossing at Cooper Landing. This gage has been maintained since May 1947. The other station, which has been maintained since May 1965, is located at the Sterling Highway crossing in Soldotna, about 7 miles below the downstream study boundary.

To supplement the records of the gaging stations and those of snow surveys, newspaper files, historical documents and records were searched for information concerning past floods. In addition, several long-time residents having knowledge of the river were interviewed. From these investigations and from studies of possible future floods on Kenai River, the local flood situation, both past and future, has been developed.

Maps used for this report were prepared utilizing photogrammetric methods during the summer of 1972. River cross sections and structural data on the bridges were obtained by field surveys.

Flood Season and Flood Characteristics

High flows have occurred in the study area during all seasons with the greatest recorded flood occurring in January 1969. This flood resulted from a rapid release of water from a glacier-dammed lake. This phenomenon is called a "jokulhlaup" flood. Ice jams also occurred within the study area causing overbank flooding of substantial depth.

Spring floods may occur as a result of an above-normal snowfall during the preceding winter, followed by an unusually

cold spring and then a rapid snowmelt. Summer and fall floods usually result from intense precipitation. The jokulhaup flood could occur at any time of the year.

Factors Affecting Flooding and Their Impact

Obstructions to the Floodflows - Natural obstructions to floodflows include trees, brush and other vegetation, growing along the stream banks in flood plain areas. There are no bridges or other man-made obstructions on the Kenai River within the study area. There is, however, a small timber bridge across Funny River just upstream from the confluence with Kenai River, and a modern steel and concrete bridge over Moose River just upstream from its confluence with the Kenai River.

During floods, trees, brush and other vegetation growing in the flood plain impede flood flows, thus creating backwater and increased flood heights. It is impossible to predict the degree or location of the accumulation of debris; therefore, for the purpose of this report, it was necessary to assume that there would be no accumulation of debris along the stream. An ice jam is another type of obstruction and would result in greatly increased flood heights. Ice jams were analyzed; however, they were not used in the development of the flood profiles.

In general, obstructions restrict floodflows and result in overbank flows and unpredictable areas of flooding, possible destruction of any bridges and an increased velocity of flow immediately downstream.

Flood Damage Reduction Measures - There are no existing flood control structures on Kenai River. Neither is there an existing borough zoning ordinance, building code or other

regulatory measure specifically for the reduction of flood damage. This study has been requested so that it may be used as a basis for the development of Flood Plain Management planning measures by the Kenai Peninsula Borough.

Other Factors and Their Impact - Flood discharges in the Kenai River are significantly less than what might be anticipated from a watershed with its area and terrain. This is the result of the moderating effect of Kenai Lake, Skilak Lake and the numerous smaller lakes in the drainage system. These lakes also moderate the effect of the jokulhlaup flood. However, if this particular type of flood occurs in the winter or early spring, ice jams could be created, resulting in a substantial level of flooding even with a relatively low volume of flow in the river. Flooding or threats of flooding promote action by local officials and individuals in flood warning and flood fighting activities.

Flood Warning and Forecasting - The National Weather Service, Alaska River Forecast Center (RFC) located in Anchorage, is responsible for flood warnings for the Kenai area. These warnings are based on current and forecast precipitation and are disseminated to the public by commercial radio and television stations and by radio station KEC-43 on a frequency of 162.5 mhz. Weather warnings and forecasts are also issued by the National Weather Service using the same communication facilities.

Flood Fighting and Emergency Evacuation Plans - Although there are no formal flood fighting or emergency evacuation plans for the area along Kenai River, provisions for alerting area residents in time of emergency are accomplished by the Alaska

Disaster Office through the Kenai Peninsula Borough. This office maintains communication with the National Weather Service at its control center, establishing a "flood watch" during the early stages of flood threat. In addition, the U. S. Geological Survey maintains a continual watch on several glacier-dammed or "dumping" lakes in the watershed. Residents along the stream are warned by radio and telephone of approaching flood conditions and advised to evacuate the area. Subsequent flood fighting, evacuation and rescue activities are coordinated on a borough-wide basis with borough officials.

Material Storage on the Flood Plain - Due to the size and nature of the development along Kenai River, there are no significant quantities of floatable materials stored in the flood plain. If they were present, they could be carried away by flood flows and could cause damage to structures downstream.

PAST FLOODS

Summary of Historical Floods

Very little information is available concerning historical floods on Kenai River since records of past floods are meager, and in some cases, non-existent. There is no record of a major flood in the Kenai River with known discharge and documented water levels. Information on historical floods was obtained primarily from interviews with residents along the river. Field investigations and office computations supplemented what data were available and were used to develop the flood profiles of this report.

Flood Records

Residents who had suffered property damage, or who had experienced flood flows, were interviewed in an effort to obtain information on past floods. Additional information on past floods was obtained from newspaper accounts and historical documents.

Flood Descriptions

The following are descriptions of the ice-jam flood that occurred on Kenai River in January 1969:

EXCERPTS FROM THE CHEECHAKO NEWS

20 JANUARY 1969

Flood Forces Evacuation

Twenty-two families, which include 81 persons, were evacuated in the wake of rising water on the Kenai River yesterday.

In addition, at least one float plane and a couple of cabins were reported swept into the river which began to rise early Saturday.

George Denison, Soldotna area Disaster Office director, said the high water was caused by a shift of Skilak Glacier.

He and C.A. "Ham" Hamilton, commander of Soldotna Squadron Civil Air Patrol, flew over the area from Skilak Glacier to the mouth of the Kenai River Saturday.

Cracks appeared in the glacier and ice was piling, he said. Skilak Lake was flooding into the Kenai River. Water also was backed into Moose River for a half mile.

Walt Pedersen who operates Pederson's Moose River Resort estimated damage to his business at $8,000. This included a plane which was damaged by the rising water and ice.

Mrs. Pederson said he was able to move the plane partially behind a building, but the wing was torn away.

Saturday afternoon, Denison warned residents on the river that the water was about 5 feet higher than during the morning.

Later the river at Soldotna Bridge was reported about 10 feet higher than usual and that ice was bombarding the abutments.

For a time, Alaska State Troopers were stationed at the bridge to keep more than one car at a time from passing over it.

Several trailer homes between Moose River and Funny River were reported swept away.

Families which were evacuated in the Soldotna-Ridgeway area reported water in basements or their homes.

River Flooded Back in 1964

The Kenai River flood in mid-December 1964 was caused by ice but at a different location and for a different reason than the present flood.

This year's apparently was caused by the shifting of a glacier which allowed water to spill into Skilak Lake.

In 1964, the flood was caused by ice jamming the river about four miles below Soldotna.

Five families were evacuated from Ciechanski Road and Rebel Run.

Families of Jake Paulk, George Denison and Roger Tachick were among those who evacuated. The same families were involved in the present flood.

Army Engineers flew over the ice jam to determine if it could be relieved by demolitions. The answer was negative.

The temperature was as low as minus 38 degrees.

The river began to rise rapidly about 9:30 a.m. Sunday, Dec. 13. It rose eight feet in 24 hours.

22 JANUARY 1969

Kenai River Still High, but Danger Subsides

Flooding conditions on the Kenai River, which has caused the evacuation of 84 persons in the Soldotna and Ridgeway areas, may continue for at least another day, according to Glen Audsley, hydrologist for Environmental Science Services Administration, Anchorage.

Water in the Kenai River is down two feet from last night, Audsley said. The danger is apparently over.

In analyzing the situation, Audsley said a temporary summer lake was formed within the glacier at Skilak Lake, storing water like a reservoir. A fracture developed resulting in a sudden release of water from the upper regions of Skilak Lake, raising lake waters about 10 inches. A wave action occurred in Skilak Lake, causing the river to flood, taking the ice with it to within the city of Soldotna and the adjacent Ridgeway area.

The sudden release of water also caused the river to change channels in several places and the Moose River to actually flow in reverse.

If it were not for the ice, Audsley said, this would not

EXCERPT FROM THE COOK INLET COURIER

FEBRUARY 1969

Rising Waters of the Kenai River

River Flood Damage

have resulted in flooding conditions.

The effect on the Kenai River, the hydrologist remarked, is like a double reservoir effect with the "perched" or temporarily formed lake still continuing to dewater, with the bulk of the water having already passed.

Meanwhile at the Greater Soldotna Chamber of Commerce luncheon yesterday, George Denison, Soldotna Disaster Office director said:

"Water under the Kenai River bridge dropped 12 inches since early this morning.

There is no change at Rebel's Run. Water there is still running but not rising. It is coming in below Sunset Park Subdivision, on across and out Big Eddy. A large ice block grounded between Bob Tachick's and Doc Wilson's and water is running around it."

Water also dropped 12 inches near the Jim Porter home on Ciechanski Road, across the river from Rebel's Run. The Porter family remained in their home although the water was in the yard.

Moose River was two feet below summer high water level and ice blocks 20 feet across and four to six feet thick filled the channel beneath the Moose River bridge.

At the Soldotna bridge over the Kenai River, there was a 13-foot ice pack and ice against the bridge abutment.

"Contrary to all rumors, Kenai Lake has not risen," Denison said. Kenai Lake is normal and the Kenai River near Hamilton's Place in the Cooper Landing area is at normal level.

"We only had half an hour warning. One minute there was nothing and it seemed like the next minute, we were full of water." That was a comment from one homeowner who lives in the flooded portion of Rebel Run Road. The jam in the Kenai River just upstream from Big Eddy caused flooding in that area up to eight feet of water. The Soldotna campground was underwater by the boat basin and though no damage was done by the Soldotna bridge, trees were uprooted by River Terrace Trailer Court. Civil Defense reports over 80 people were evacuated from the Rebel Run and Ciechanski Road areas of Ridgeway. There were reports of some looting on Rebel Run but these reports have not been confirmed. One homeowner in the Rebel Run area said he was uninformed that the area was a flood plain. One man who had been involved in cleaning out two houses in the first three days commented, "Where was the help? Why weren't any coffee kitchens set up? No one loaned us boats or tried to help in any way. Where were the Civil Defense people?" Ham Hamilton and Ted Grainge of the CAP flew the river from Soldotna to Kenai and reported the cause of the flooding to be the jam at Big Eddy. A partial damage estimate as of Tuesday put the damage cost at well over 50,000 dollars. In Sterling, 11 riverboats, 1 floatplane, a store and several cabins were damaged. On Midway Road trailers, lean-to's, boats and some houses were damaged, and one 2 bedroom house was reported washed completely off its foundations. The Scout Loop area reports cabins and trailers under almost three feet of water. Concrete Products of Alaska in Soldotna reports one house trailer severely damaged and damage to many concrete blocks. Wildwood Air Force Station gave shelter to two families Saturday night and provided rations for two others. It is likely that when waters recede, the homes that once were nestled cozily along the River's bank will no longer be there, but will, with break-up, join the flotsam and jetsam of the Inlet. Mr. Sheldon Bergeson, Field Director with the Armed Forces and Red Cross Disaster Representative for this area said that Civil Defense alerted him Saturday night. Mr. Bergeson and Mr. John Allred, Red Cross Field Director at Elmendorf, arrived in Soldotna Tuesday morning. They set up an office in Soldotna City offices to assist flood victims. Mr. Bergeson has promised help in meeting the emergency needs of food and clothing and has said the Red Cross will, if the need is great, help with funds for shelter. They will also issue purchase orders to be honored by local merchants.

EXCERPTS FROM THE CHEECHAKO NEWS

14 OCTOBER 1969

Kenai River Continues to Rise

The state campgrounds next to Sportsmen's Lodge at Cooper Landing is under water and water has flooded the basement of Gwinn's Lodge in the Cooper Landing area, George Denison, deputy civil defense director for the Kenai Peninsula Borough said Monday night.

Waters of the Kenai River are continuing to rise, although not as rapidly as the past few days, Denison said. Oddly, he said, most of the rise comes between midnight and 6 a.m. each day.

In the 24-hour period from 6 p.m. Monday, the river as measured under the bridge at Soldotna recorded a rise of 5¼ inches as compared to 7 inches during the preceding 24 hours.

Sportsmen's Lodge, Gwinn's and other business places and residences in the Moose Pass-Cooper Landing area are also without electricity, Denison said. A U.S. Corps of Engineers representative working in the area said approximately 500 trees had blown down in the Moose Pass-Cooper Landing area. High winds Saturday night and Sunday were also responsible for electrical outage in other areas of the Kenai Peninsula. The Soldotna and Kenai fire departments were both called out to extinguish fires started by a "hot" line blown down by the wind.

Don Gallagher, borough civil defense director, and Denison are keeping a strict watch on the river and are measuring the water every three hours. With exception of the Cooper Landing report, he said, there has been no other report of flooding.

The Jake Paulk family near Soldotna evacuated their home on the river bank and moved into a newer home they built on Poppy Lane. The Paulks have had previous experience of being flooded out by the Kenai River.

Self Dumping Lake Filling up Could Cause Kenai River Flood

Aerial observations are continuing on a self-dumping lake forming in the icefields above the Snow River on the Kenai Peninsula by hydrologists of the Alaska District of the U.S. Army Corps of Engineers.

From the air the lake appears to be fuller than previous high-water marks, according to the Engineers, and given the right conditions, it may dump into Snow River, run through Paradise valley into the Kenai River and Kenai Lake, down the Kenai River to Skilak Lake and on down into the lower Kenai River.

Kenai and Skilak Lakes are expected to be able to absorb the greater part of the additional flow without a major rise on the Kenai River if the lake dumps before freeze-up. The lake's most recent dumping was in September 1967.

In cooperation with the Alaska Disaster Office, the Corps of Engineers will continue to keep the 'jokulhlaup' under observation, and if dumping occurs the Weather Bureau will alert residents of the area.

Hydrologists of the United States, Canada, and particularly in Norway where the term 'jokulhlaup' originates, are studying the phenomenon, but as yet it is not clearly understood. Glacial movement is thought to underlie the lack of firm pattern of sealing and dumping, or remaining open and continuing to drain off.

FIGURE 3 - January 1969 flood on Kenai River at Moose River. (Courtesy of Laura Tyson).

FIGURE 4 - Ice left behind at Moose River by the January 1969 flood on Kenai River. (Courtesy of Laura Tyson).

FIGURE 5 - Flooding in the Kenai - Soldotna area in January 1969. (Courtesy "Cook Inlet Courier").

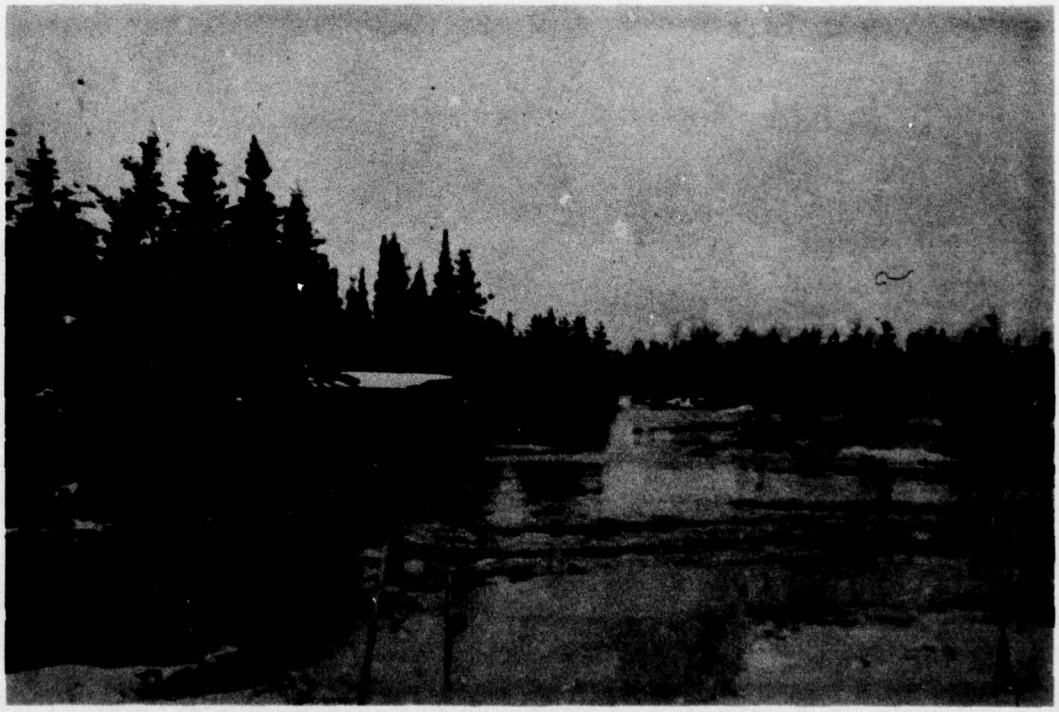


FIGURE 6 - Overbank flooding during the January 1969 flood on Kenai River. (Courtesy "Cook Inlet Courier").

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occurred in the past will occur in the future. Larger floods have been experienced in the past on streams with similar geographical and physiographical characteristics as those found in the study area. Similar combinations of rainfall and runoff which caused these floods could occur in the Kenai River area. Therefore, to determine the flooding potential of the study area, it was necessary to consider storms and floods that have occurred in regions of like topography, watershed cover, and physical characteristics. Discussion of the future floods in this report is limited to those that have been designated as the Intermediate Regional Flood, the Standard Project Flood and Ice-Jam Floods. The Standard Project Flood represents a reasonable upper limit of expected flood flows in the study area. The Intermediate Regional Flood may reasonably be expected to occur more frequently, although it will not be as severe as the infrequent Standard Project Flood. No frequency is assigned to the ice-jam floods; however, experience has shown that they can be expected to occur more frequently than the Intermediate Regional Flood.

Intermediate Regional Flood

The Intermediate Regional Flood (IRF) is defined as one that will occur once in 100 years on the average, although it could occur in any year. The peak flow of this flood was developed from a statistical analysis of streamflow and precipitation records and a study of runoff characteristics; however, limitations in Kenai River Basin data required analysis on a regional rather

than a watershed basis. In determining the Intermediate Regional Flood for Kenai River, statistical studies were made using flood data from U. S. Geological Survey gaging stations and precipitation data from National Weather Service climatological stations in the vicinity of Sterling and Kenai, Alaska. The peak flow developed for the Intermediate Regional Flood in the study area is 37,500 cubic feet per second (cfs).

Standard Project Flood

The Standard Project Flood is defined as a major flood that can be expected to occur from a severe combination of meterological and hydrologic conditions that is considered reasonably characteristic of the geographical area in which the study area is located, excluding extremely rare combinations. The Corps of Engineers, in cooperation with the NOAA Weather Service, has made comprehensive studies and investigations based on the past records of experienced storms and floods and has developed generalized procedures for estimating the flood potential of streams. The peak discharge for the Standard Project Flood on Kenai River at Soldotna has been computed to be 62,000 cfs. A discharge hydrograph for the Standard Project Flood on Kenai River at Soldotna is shown on Plate 20.

Ice Jam Floods

The severe nature of Alaskan winters lends to another type of flooding along the Kenai River. With a heavy ice cover on the river, untimely breakups or the jokulhlaup effect (the sudden release of glacier-dammed waters) can cause the ice to jam. Ice jams usually occur at natural restrictions or bends in the river

and can cause water to back up and flood low areas. Although the volume of flow in the river may be less than the IRF or the SPF, the resulting level of flooding could be substantially higher.

TABLE 2

FLOOD ELEVATIONS

Kenai River at Moose River

Flood	Elevation (a)
Standard Project	154.0
Intermediate Regional	149.7
January 1969	146

(a) Feet, Mean Sea Level

Frequency

A frequency curve of peak flows was constructed on the basis of available information and computed flows of floods up to the magnitude of the Standard Project Flood. The frequency curve thus derived, which is available upon request, reflects the judgment of the engineers who have studied the area and are familiar with the region; however, it must be regarded as approximate and should be used with caution in connection with any planning of flood plain use. Floods larger than the Standard Project Floodare possible, but the combination of factors necessary to produce such a large flood would be extremely rare.

Hazards of Large Floods

The extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, developments in the flood plain and the effectiveness of flood fighting efforts. Floodwaters flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater 3 feet deep or more and flowing at a velocity of 3 feet per second or more, could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Water lines could be ruptured by deposits of debris and the force of floodwaters, and wells could be flooded, thus creating the possibility of contaminated domestic water supplies. Isolation of areas by floodwater could create hazards in terms of medical, fire or law enforcement emergencies.

Flooded Areas and Flood Damage - The areas along Kenai River that would be flooded by the Intermediate Regional and Standard Project Floods are shown on Plates 3 through 13. The actual limits of overflow may vary somewhat from those shown on the maps because the 5 foot contour interval and the scale of the maps do not permit precise plotting of the flooded area boundaries. As may be seen from the flooded area maps, flood-flows from Kenai River cover only a small amount of overbank area. The runoff from large storms is so moderated by the regulating effect of Kenai Lake, Skilak Lake, and lesser lakes and swamps in the Kenai River watershed that the Intermediate Regional and Standard Project Flood discharges will create lower levels of flooding than have historically occurred from ice

jam created backwaters occurring under substantially smaller flows. The area flooded by the Intermediate Regional Flood is not large and the principal damage that would occur would be to the residential and recreational development along the river. Damage would be more severe during a Standard Project Flood due to the wider extent and greater depths of flooding. Plates 14 through 17 show water surface profiles for the IRF and SPF. Depth of flow can be determined from these illustrations. Typical cross sections of the flood plain at selected locations, together with the water surface elevation and extent of the IRF and SPF, are shown on Plates 18 and 19.

Obstructions - Ice jams present the only major obstruction to flow on the Kenai River in the study area. Flooding due to ice jams is known to occur in the vicinity of the confluence with Moose River at Sterling, as well as at other locations downstream in the study section. However, the formation of ice jams is more or less a random event and is relatively unpredictable as to location. Due to this fact the area subject to flooding as a result of ice jams has not been shown on the flooded area maps or on the profiles. Whenever one of significant size does occur in the Kenai River, local flooding to substantial depths will result in the overbank areas. Immediately above the jams, water depths may be expected well in excess of those resulting from the largest storm-caused floods. The following page shows some of the results of previous ice jams on the Kenai River.

Velocities of Flow - Water velocities during floods depend largely on the size and shape of the stream and the bed slope, all of which vary on different streams and at different locations on the same stream. During the Intermediate Regional and Standard

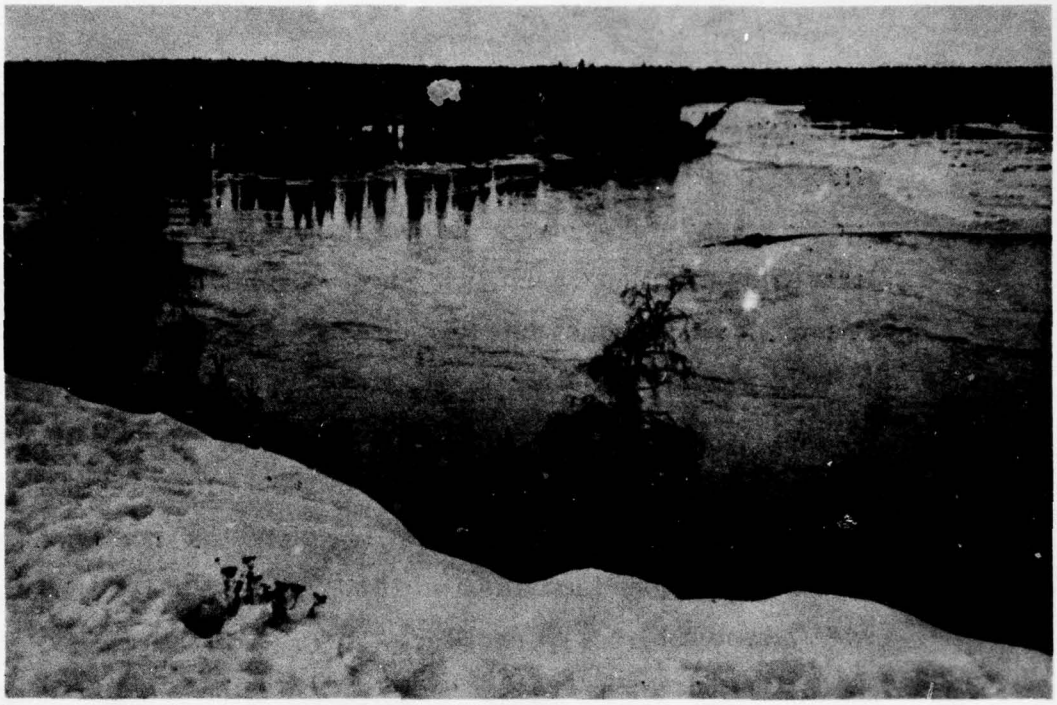


FIGURE 7 - An ice jam on the Kenai River caused this flooding. (Courtesy "Cook Inlet Courier").

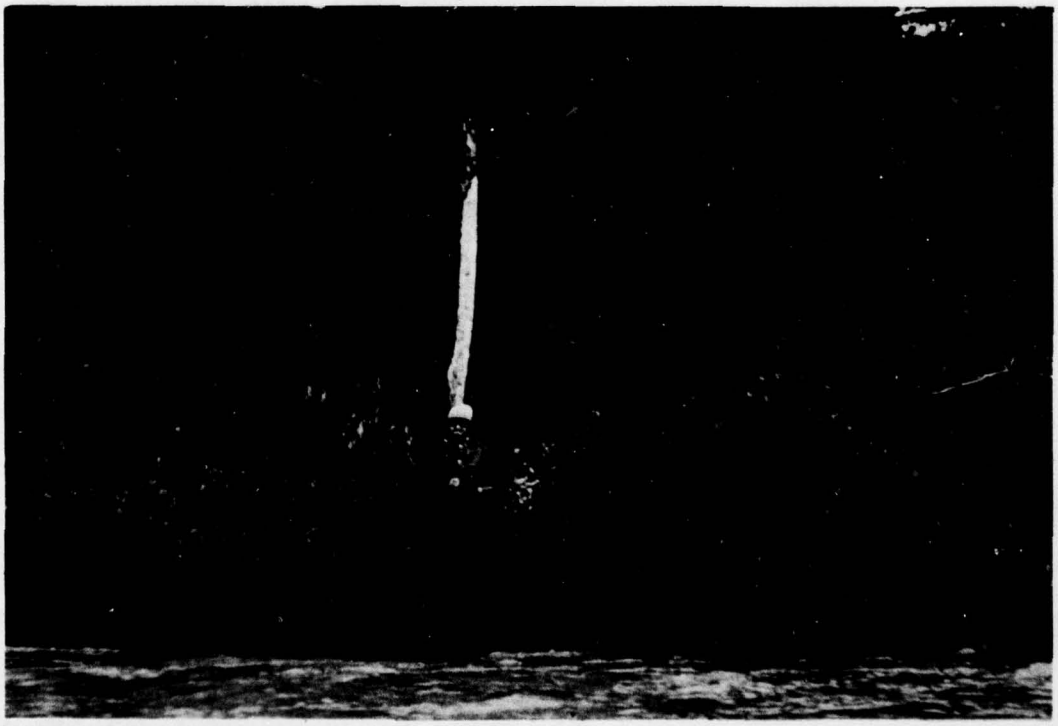


FIGURE 8 - This tree shows evidence of previous ice jams and is typical of many along the Kenai River.

Project Floods, average velocities of main channel flow is about 7.5 and 9 feet per second, respectively. Velocities of this magnitude are sufficient to cause severe erosion to banks, move structures off their foundations, transport vehicles, and cause similar damages. Overbank flow would average 1 foot per second.

Rates of Rise and Duration of Flooding - Intense rainfalls that accompany severe storm fronts usually produce the floods that occur on Kenai River. Floods are also caused by a rapid release of water in glacier-dammed lakes. Due to the regulating effects of the lakes in the watershed, there is a moderate time lag before flooding actually begins. In the case of an ice jam flood, however, flood waters will generally rise rapidly and then will recede rapidly when the ice jam breaks.

Photographs, Future Flood Heights - The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations in the study area are indicated on the following photographs:

FIGURE 9 - Future flood heights on Kenai River at the Slash E Ranch.

FIGURE 10 - Future flood heights at the confluence of the Kenai and Funny Rivers.

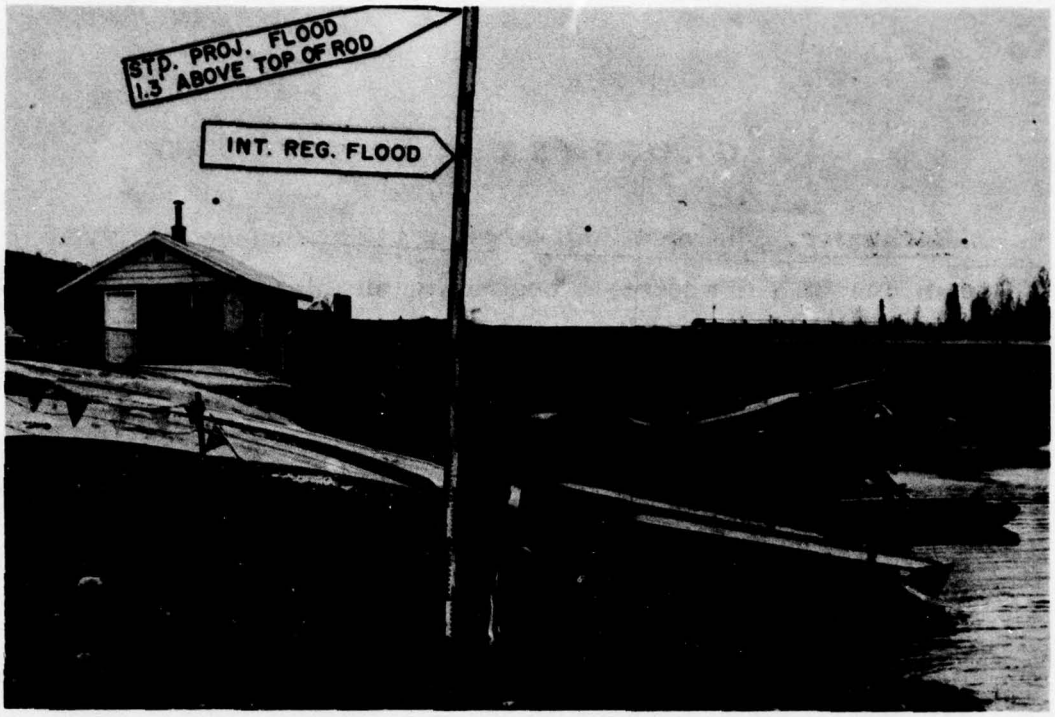


FIGURE 11 - Future flood heights at the confluence of the Moose and Kenai Rivers.

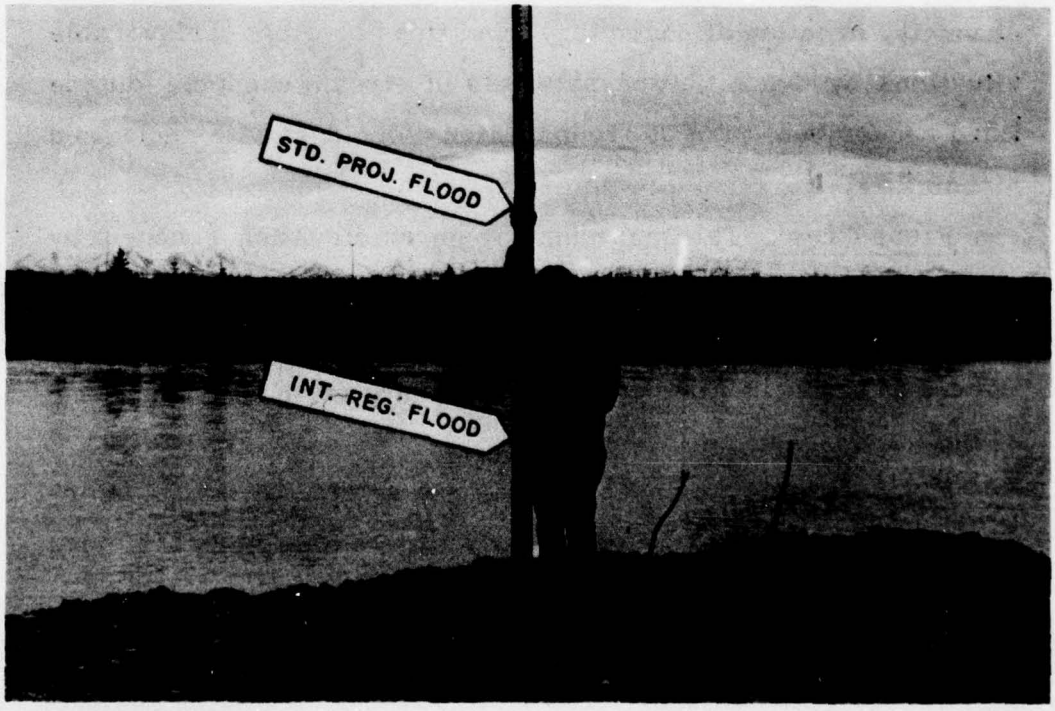


FIGURE 12 - Future flood height at Cross Section 15. Fill is about 6 feet above the water surface.

GLOSSARY

Backwater. The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood. An overflow of lands not normally covered by water that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain. The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Hydrograph. A graph showing flow values against time at a given point, usually measured in cubic feet per second. The area under the curve indicates total volume of flow.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Left Bank. The bank on the left side of a river, stream or watercourse, looking downstream.

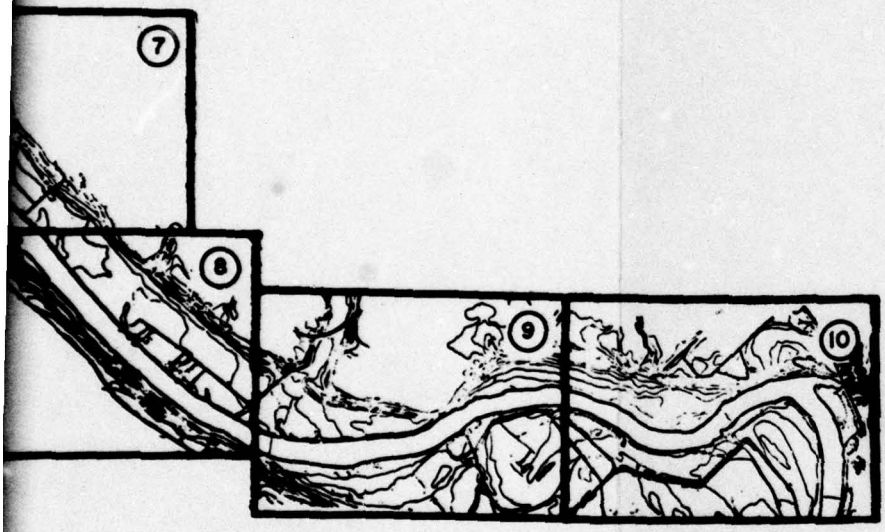
Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and

hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40-60 percent of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance Elevation. The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.


3
4
5
6
KENA
RIVER



LEGEND

(6) PLATE NUMBER

0' 3000' 6000'

APPROXIMATE SCALE IN FEET

INDEX MAP
FLOOD PLAIN INFORMATION
KENAI RIVER
KENAI PENINSULA BOROUGH
ALASKA

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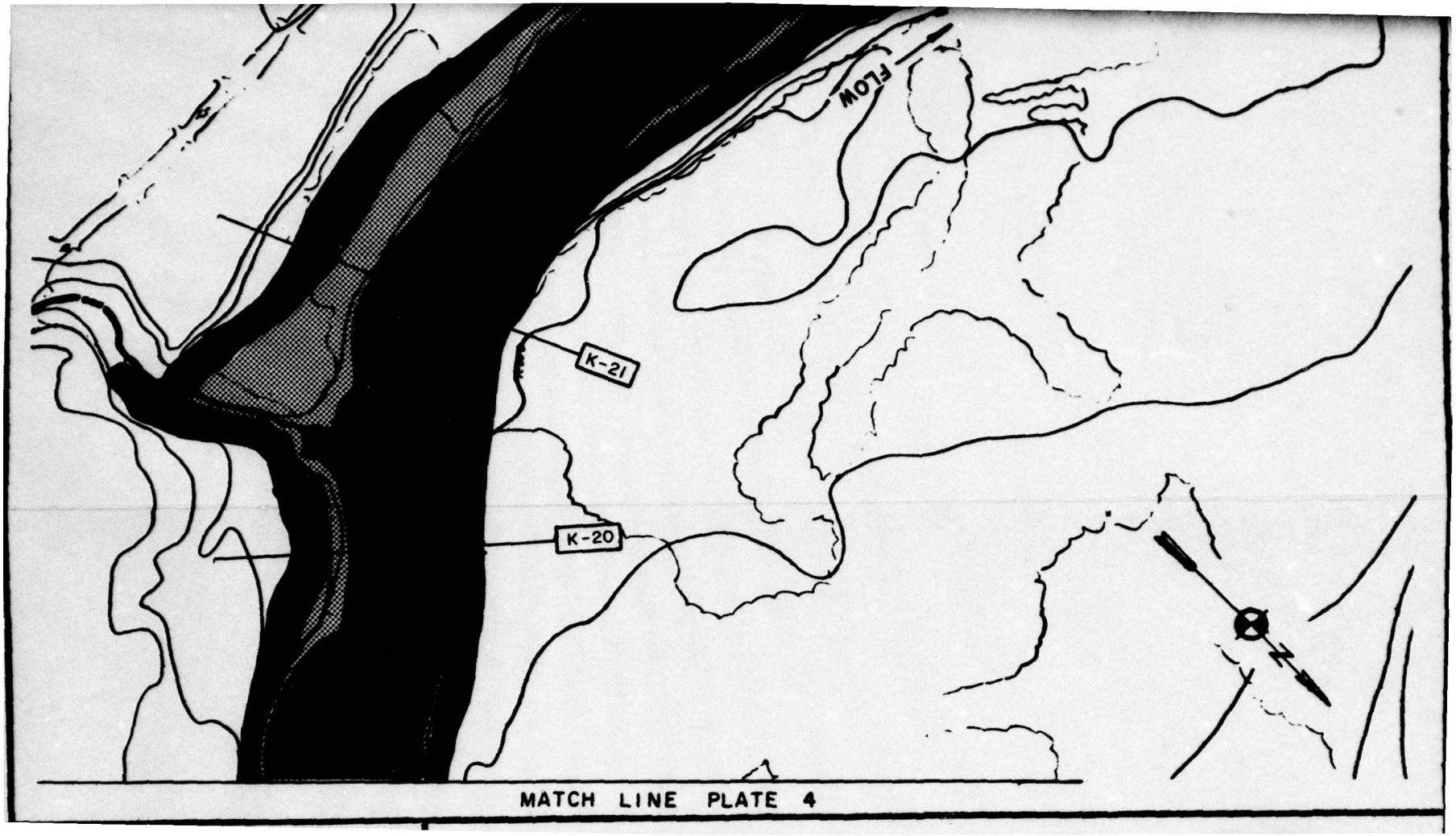
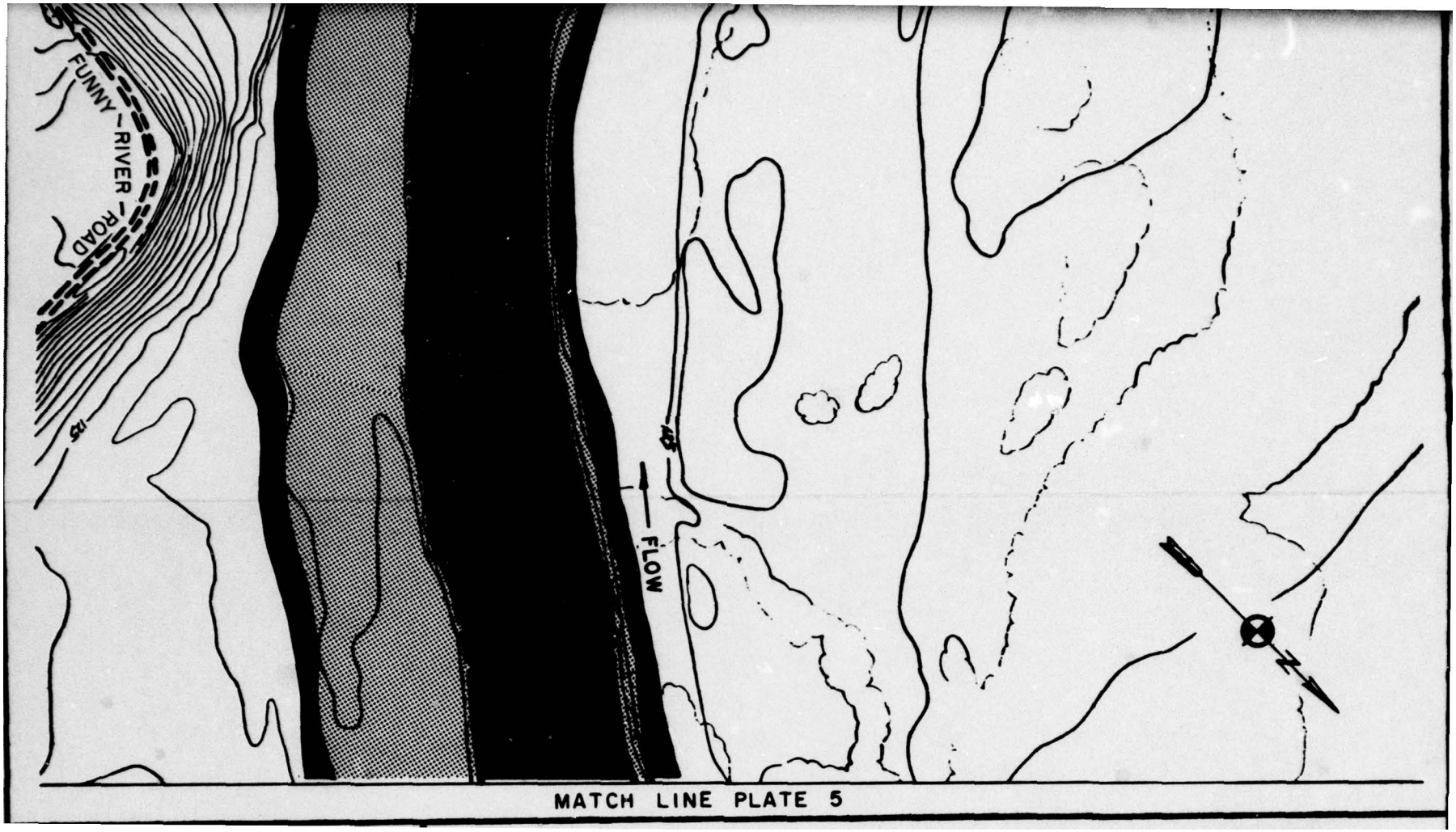
ANCHORAGE, ALASKA

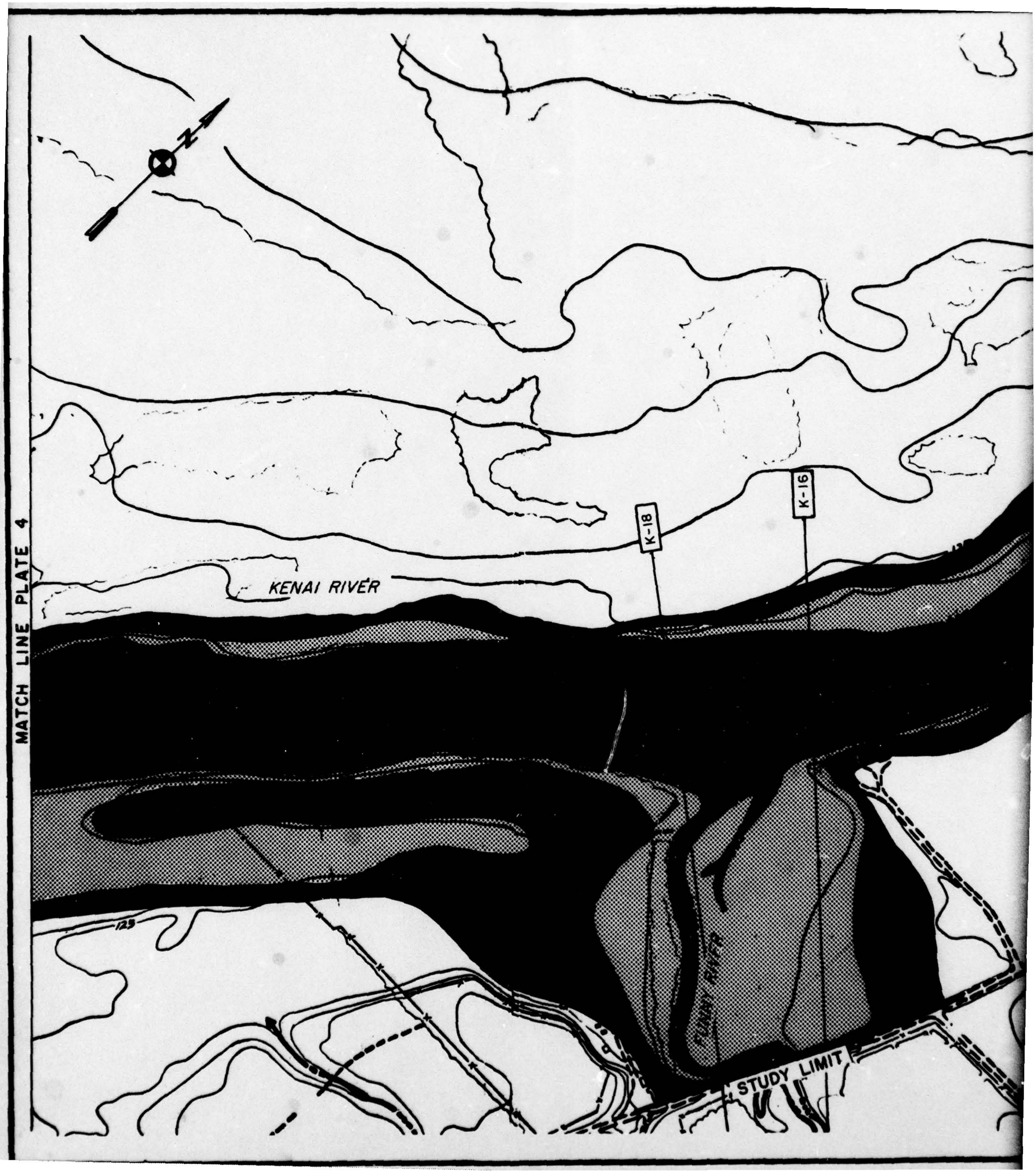
JUNE 1973

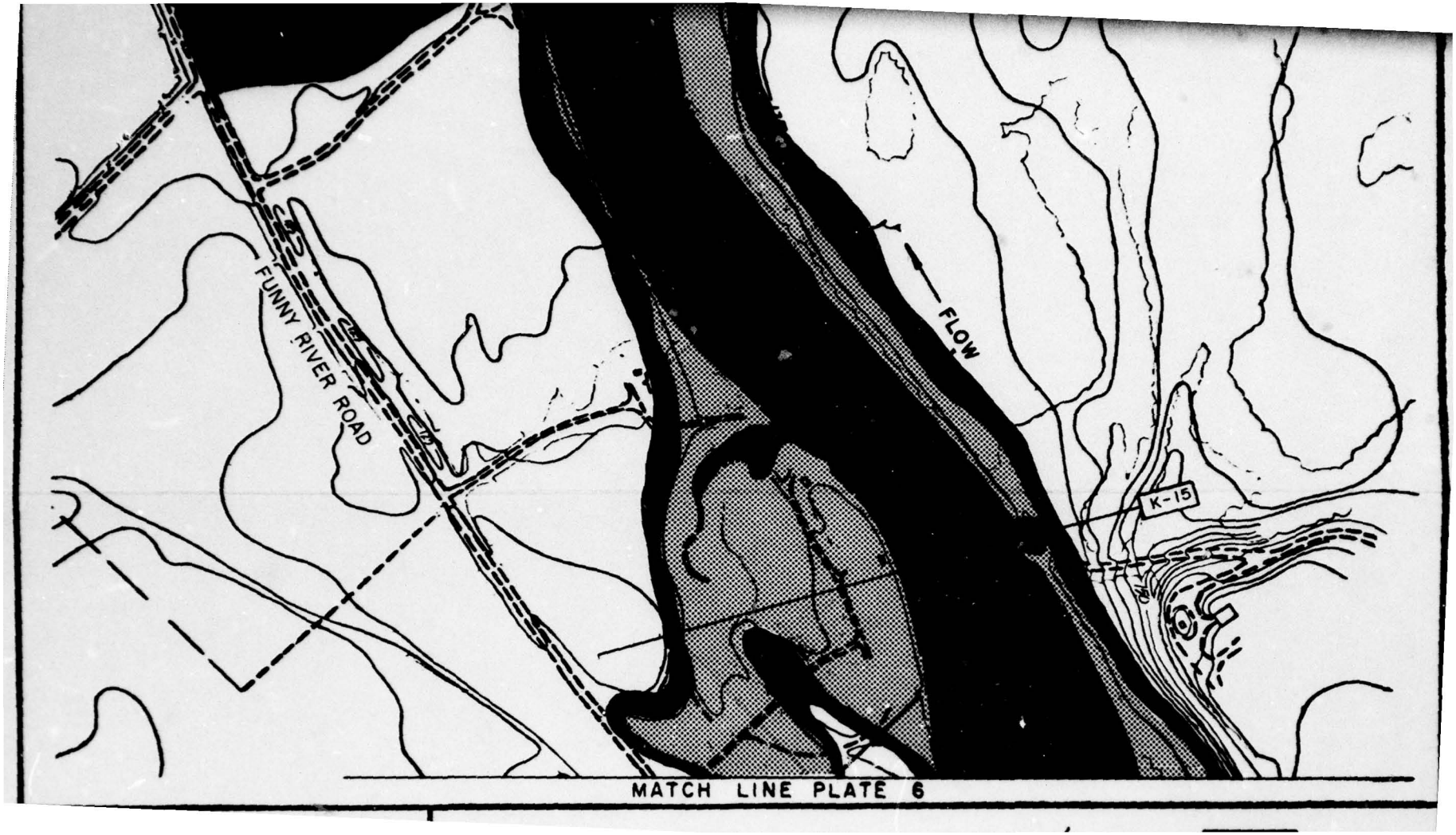

STUDY LIMIT
KENAI RIVER
K-22
K-23
FLOW

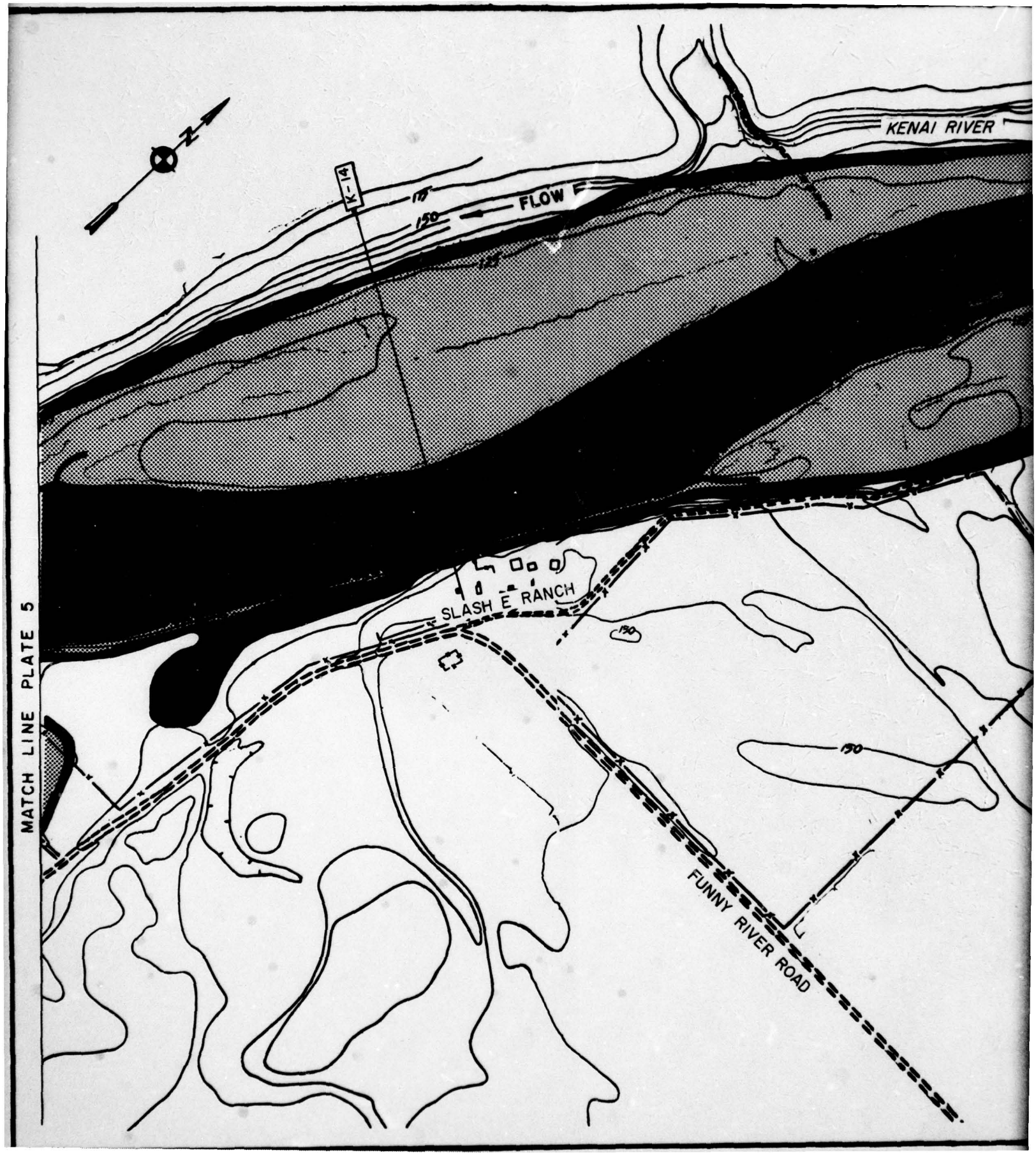

FLOW
K-21
K-20
MATCH LINE PLATE 4

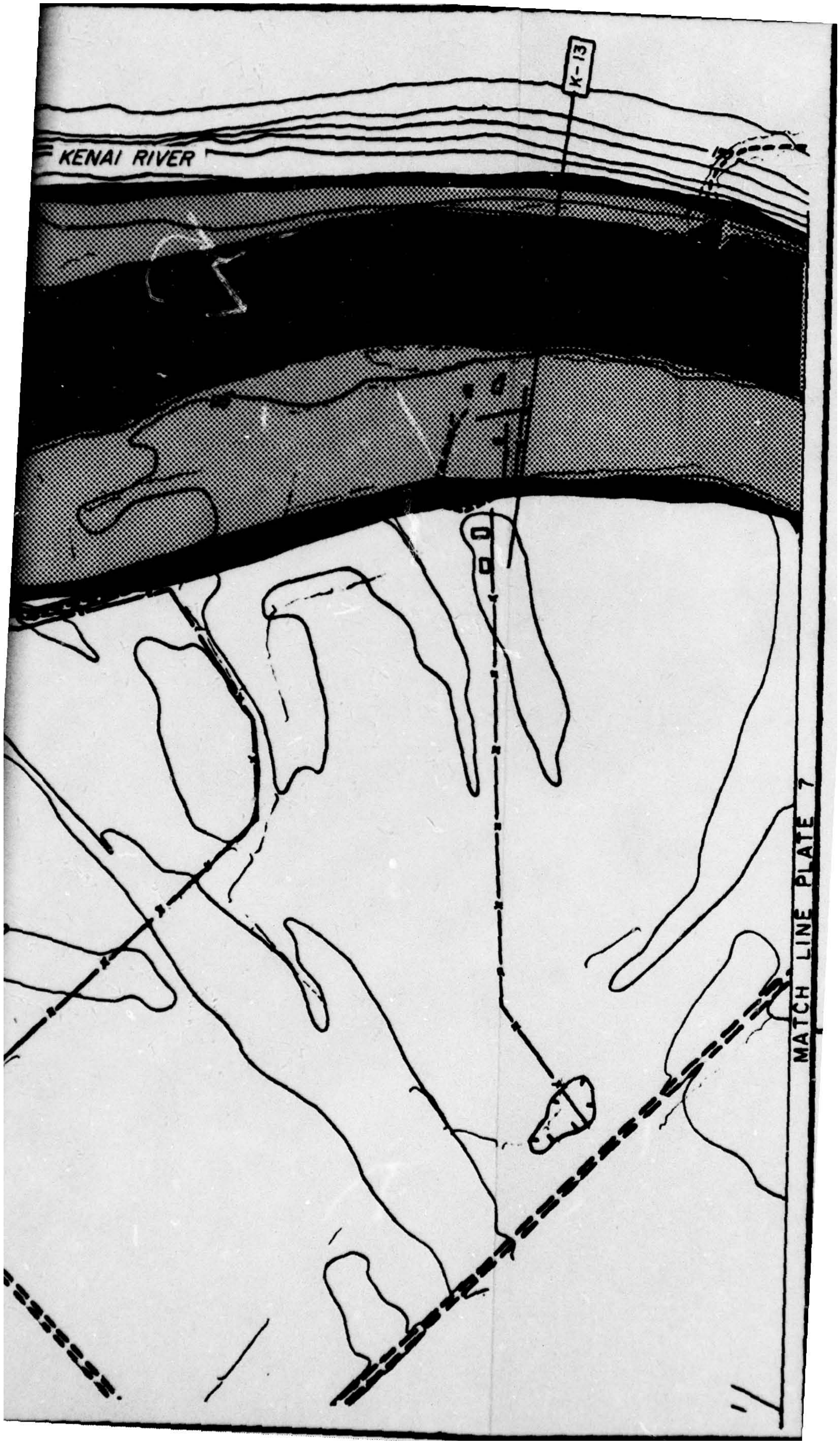

MATCH LINE PLATE 3
K-19
KENAI RIVER
FUNNY-RIVER

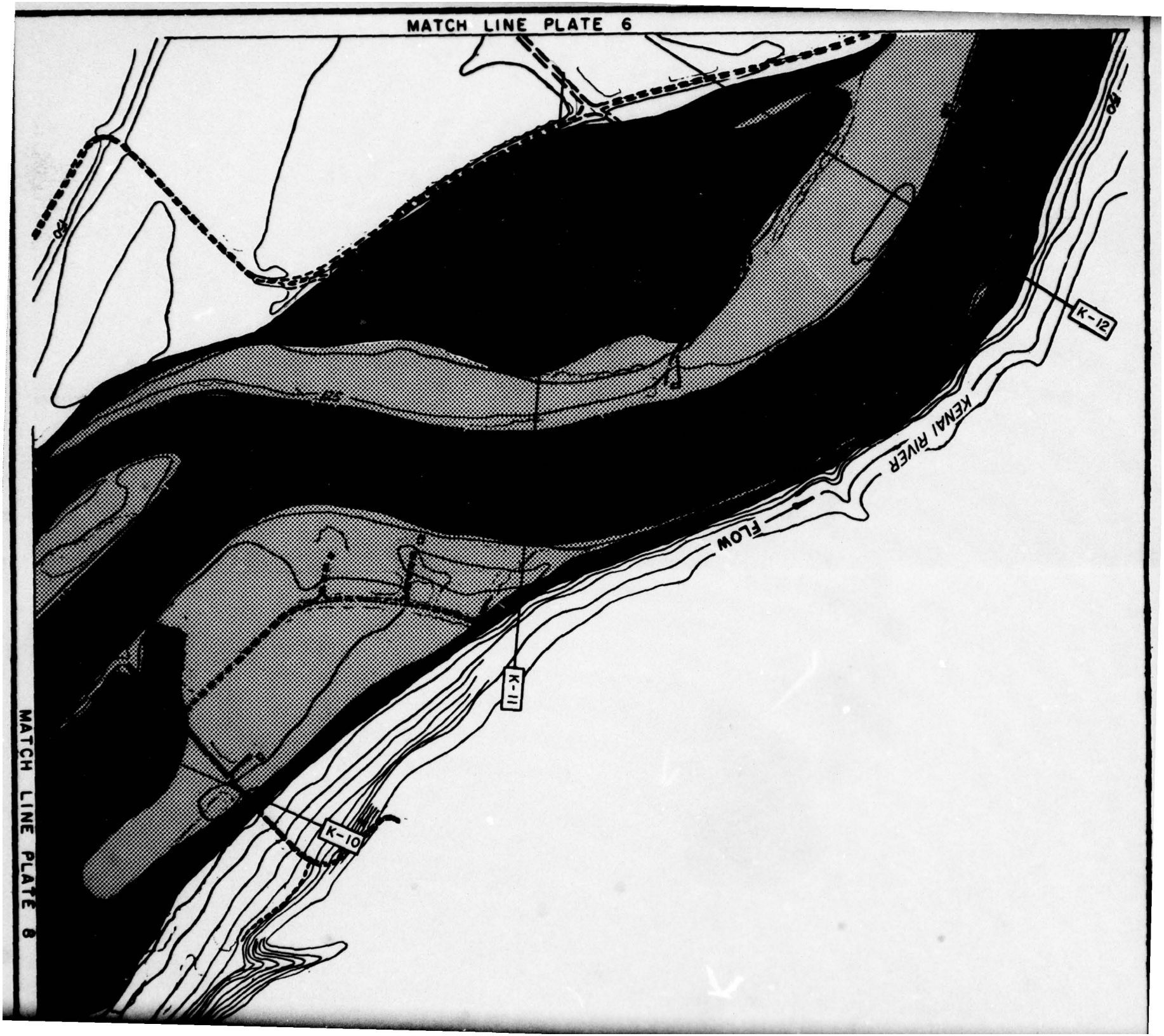

FUNNY - RIVER - ROAD
15
45
FLOW
MATCH LINE PLATE 5

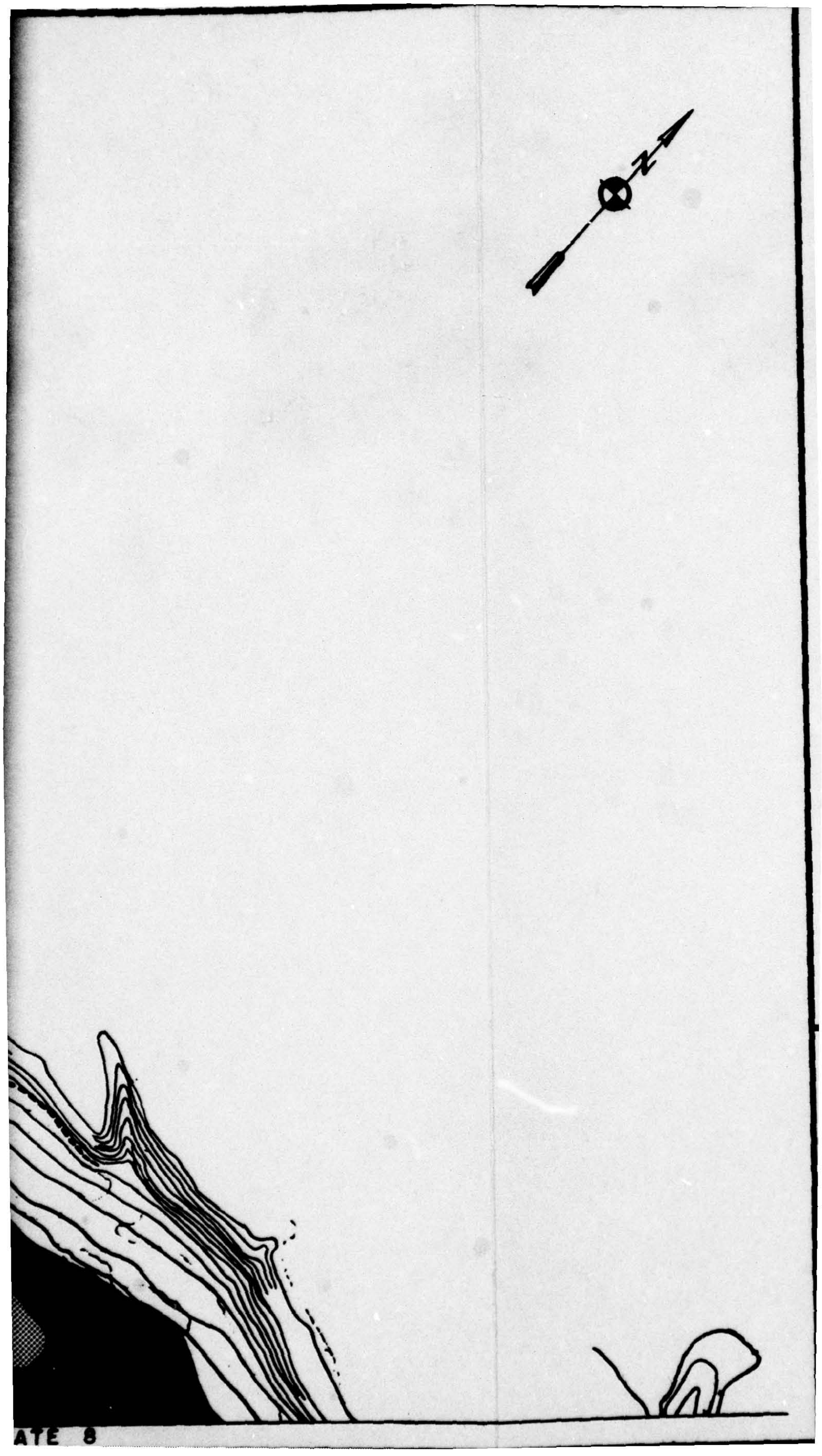

MATCH LINE PLATE 4
KENAI RIVER
K-18
K-16
123
STUDY LIMIT


FUNNY RIVER ROAD
FLOW
K-15
MATCH LINE PLATE 6

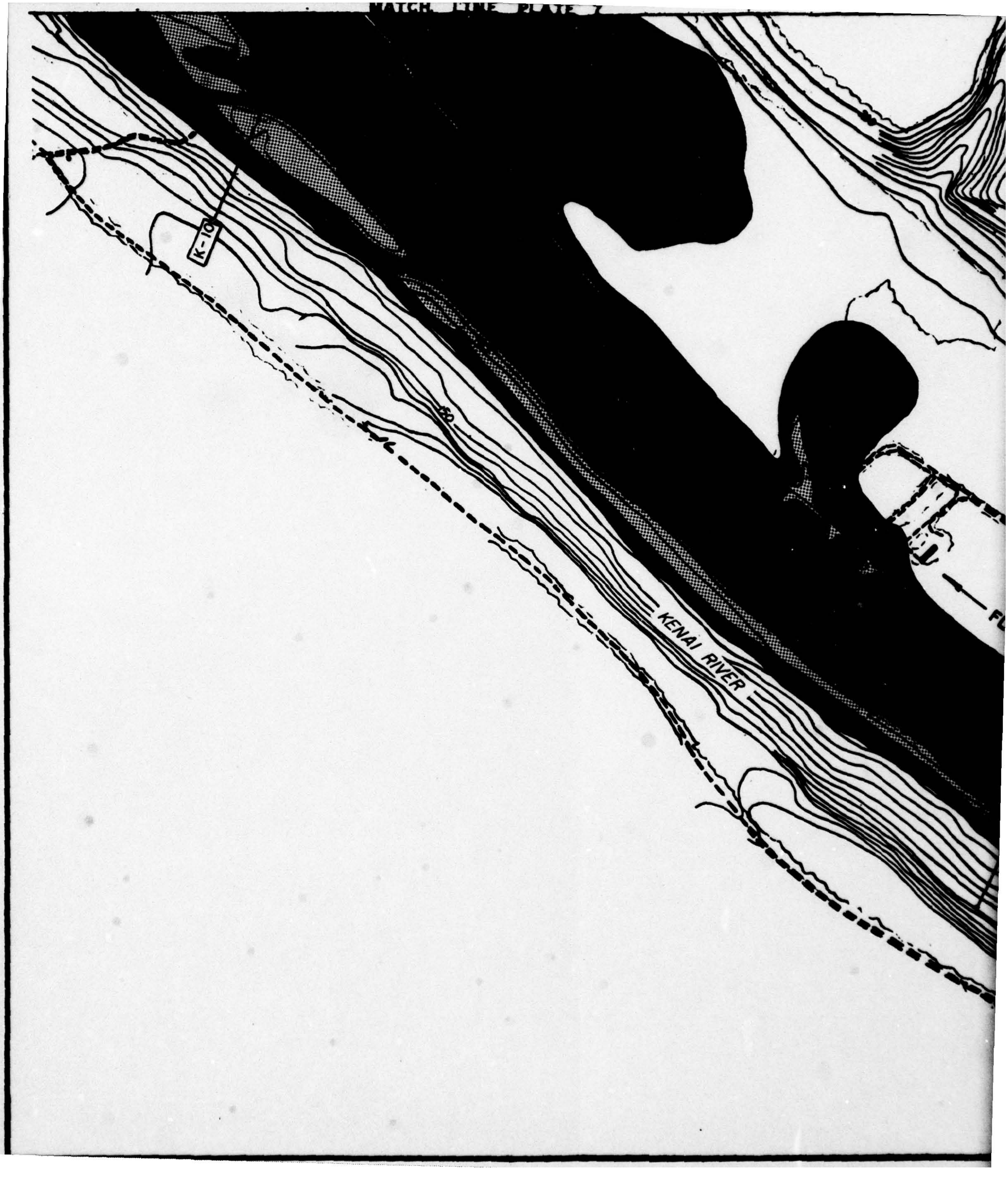

KENAI RIVER
FLOW
K-14
115
150
SLASH E RANCH
FUNNY RIVER ROAD
MATCH LINE PLATE 5


K-13
KENAI RIVER
MATCH LINE PLATE 7


MATCH LINE PLATE 6
K-12
KENAI RIVER
FLOW
K-11
K-10
MATCH LINE PLATE 8



ATE 8


MATCH LINE PLATE 7
K-10
60
KENAI RIVER


FLOW
K-9
K-8
N
MATCH LINE PLATE 9


MATCH LINE PLATE 8
K-7
FLOW
200
KENAI

LEGEND

OVERFLOW LIMITS

STREAM CHANNEL
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

K+4 MILES ABOVE MOUTH

K-3 CROSS SECTION

~ 250 ~ GROUND ELEVATION IN FEET SEA LEVEL DATUM, (POST QUAKE).

NOTES

1. MAPPING BASED ON AERIAL PHOTOGRAPHS TAKEN IN SEPTEMBER 1972.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. CONTOUR INTERVAL IS 5 FEET.

0' 400' 800'

SCALE IN FEET

FLOODED AREA MAP
FLOOD PLAIN INFORMATION
KENAI RIVER
KENAI PENINSULA BOROUGH
ALASKA

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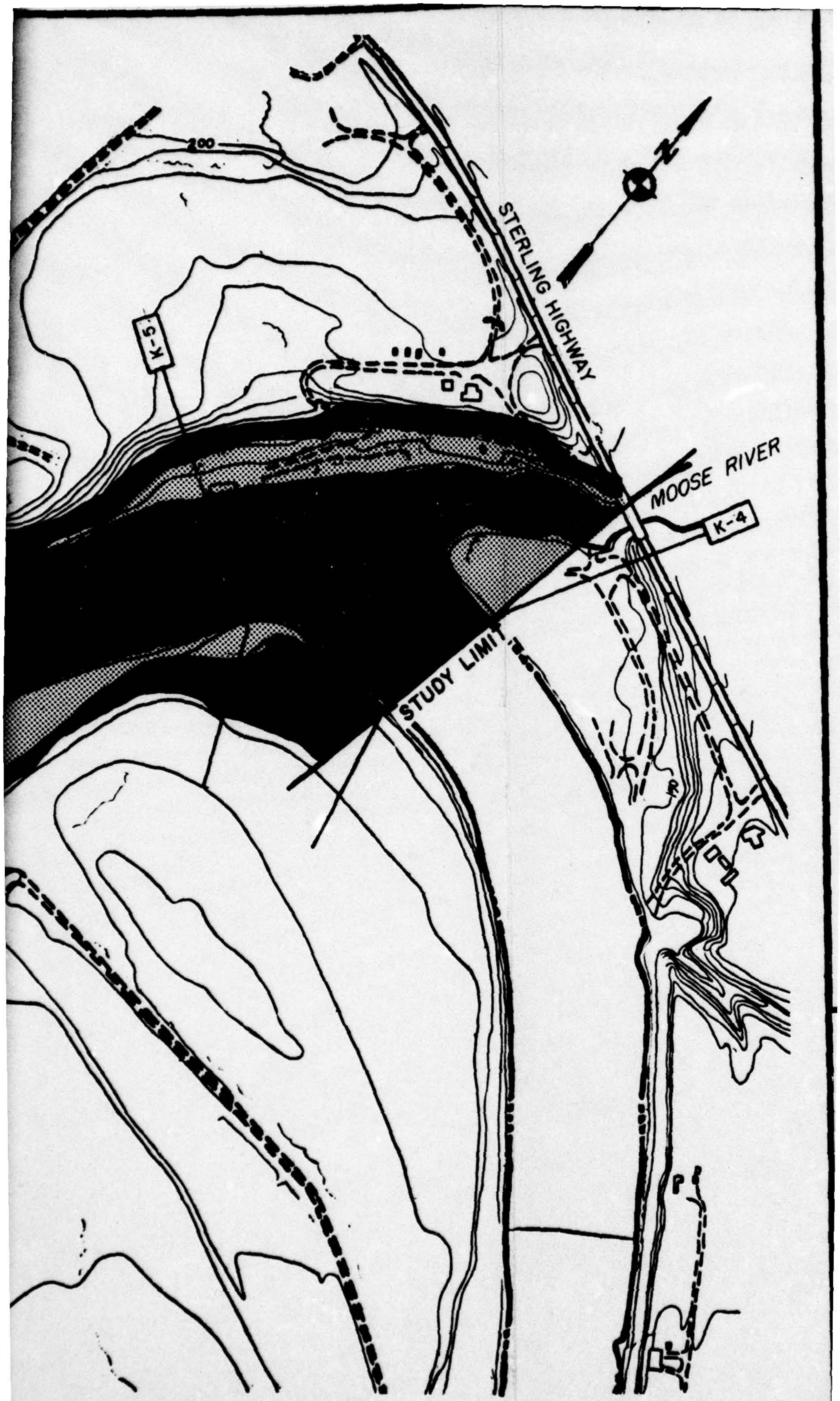
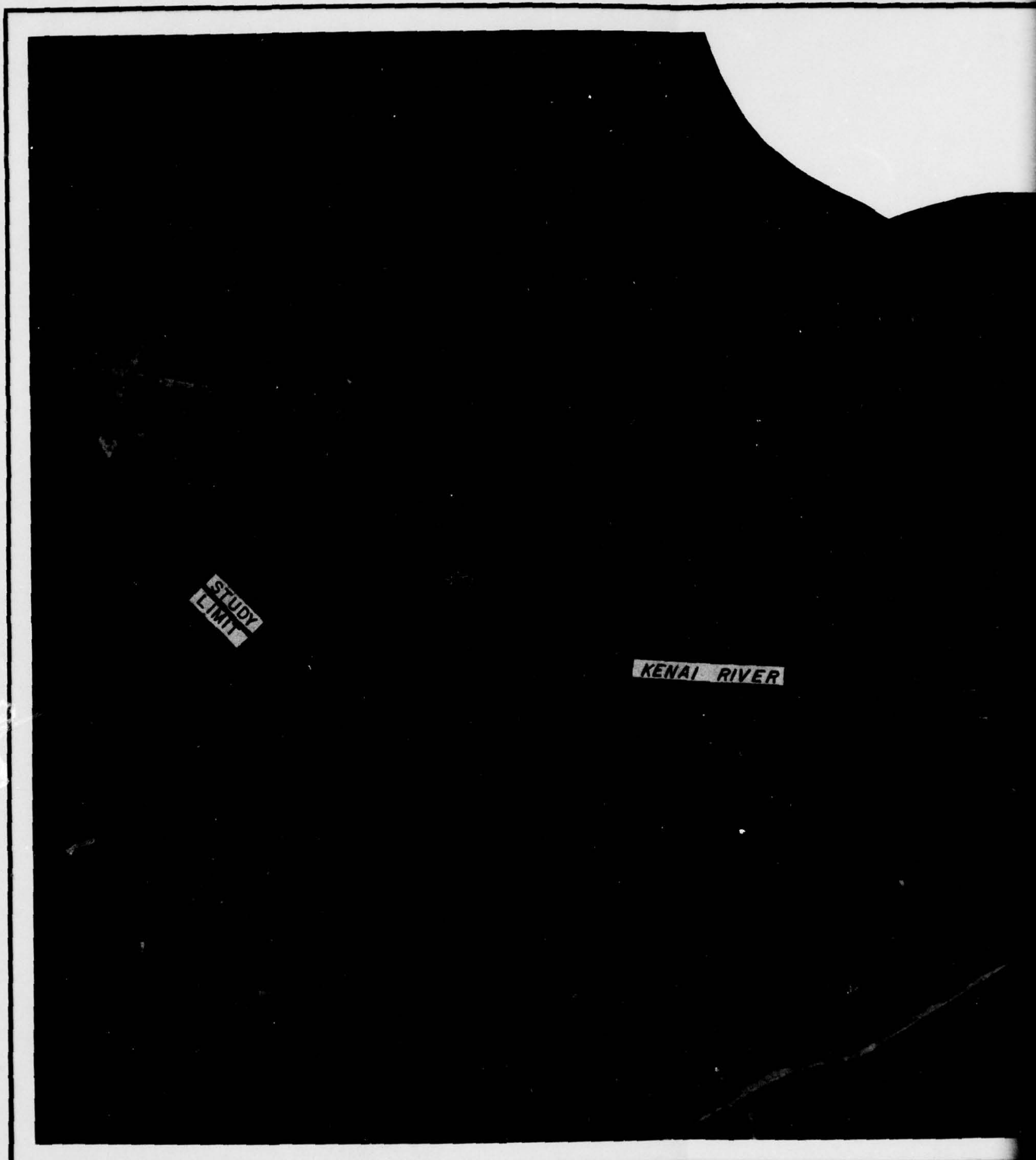
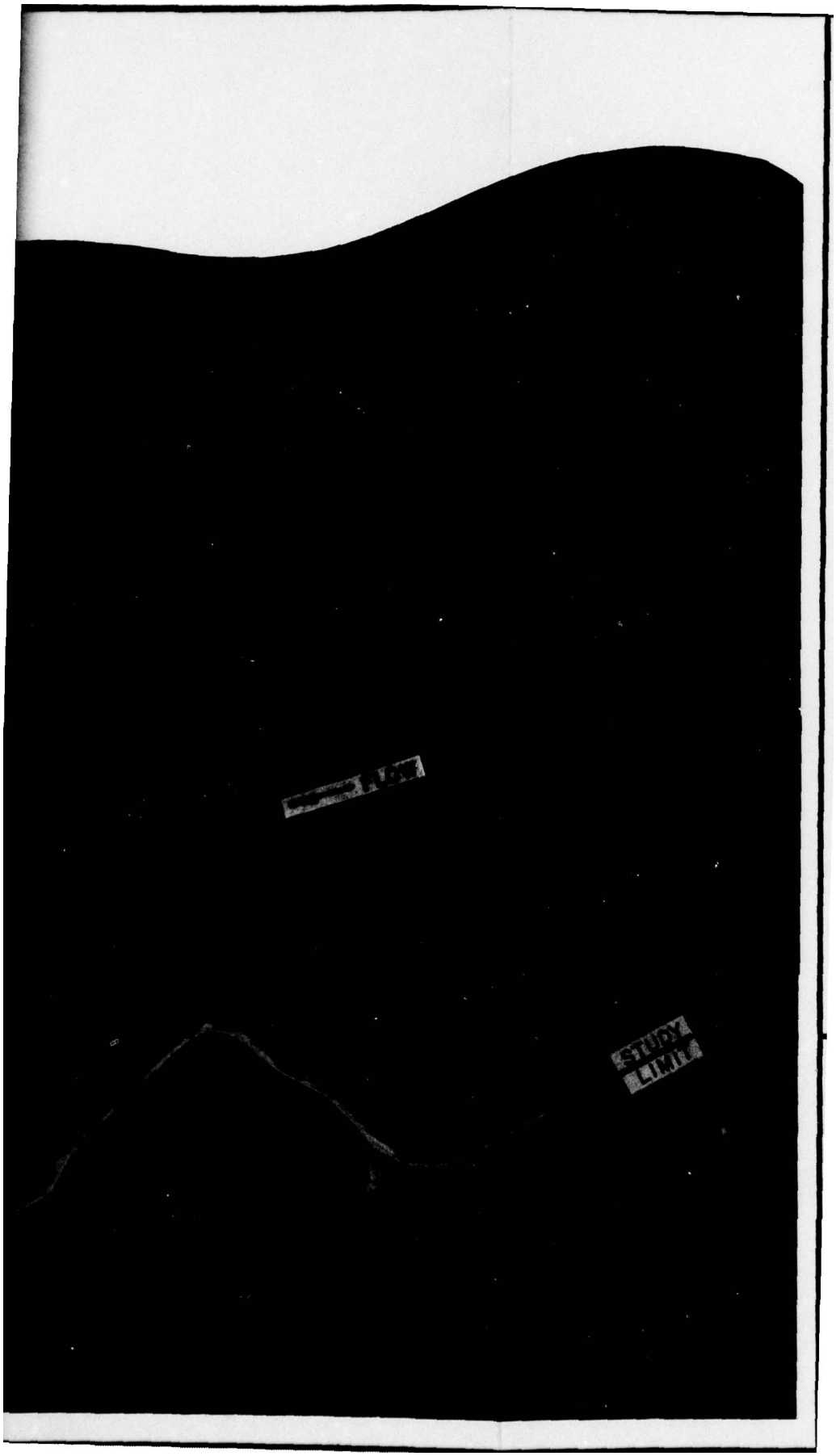
JUNE 1973

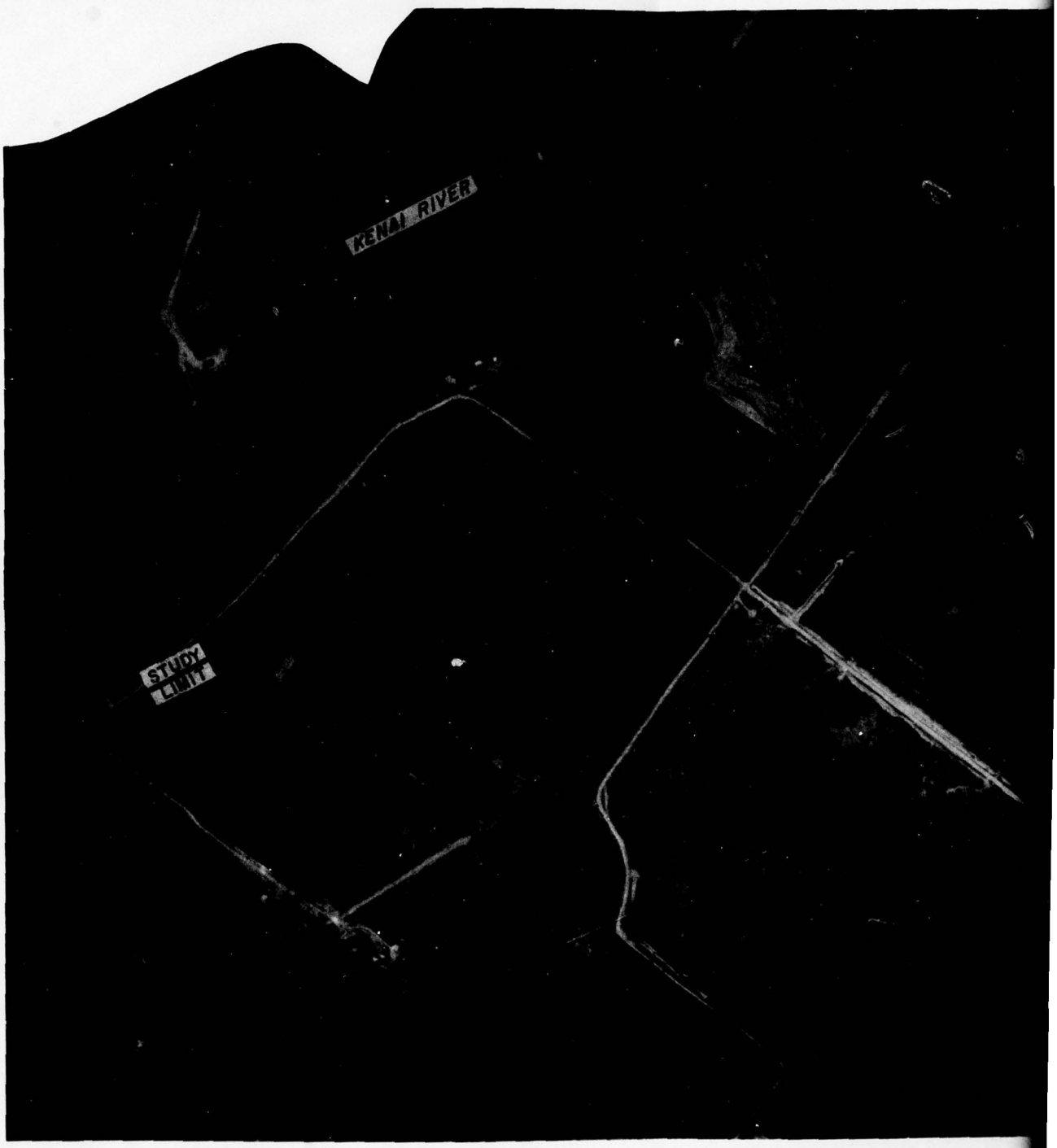

MATCH LINE PLATE 9
200
200
200
200
210
K-6
FLOW
KENAI RIVER
175
175
175
175
175
175
FUNNY RIVER ROAD



200
STERLING HIGHWAY
K-5
MOOSE RIVER
K-4
STUDY LIMIT
P


STUDY LIMIT
KENAI RIVER


STUDY
LIMIT

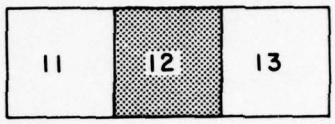

KENAI RIVER
STUDY
LIMIT

LEGEND

OVERFLOW LIMITS

STANDARD PROJECT FLOOD

INDEX MAP



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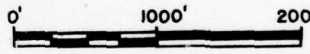
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.



APPROXIMATE SCALE IN FEET

FLOODED AREA MAP
FLOOD PLAIN INFORMATION
KENAI RIVER
KENAI PENINSULA BOROUGH
ALASKA

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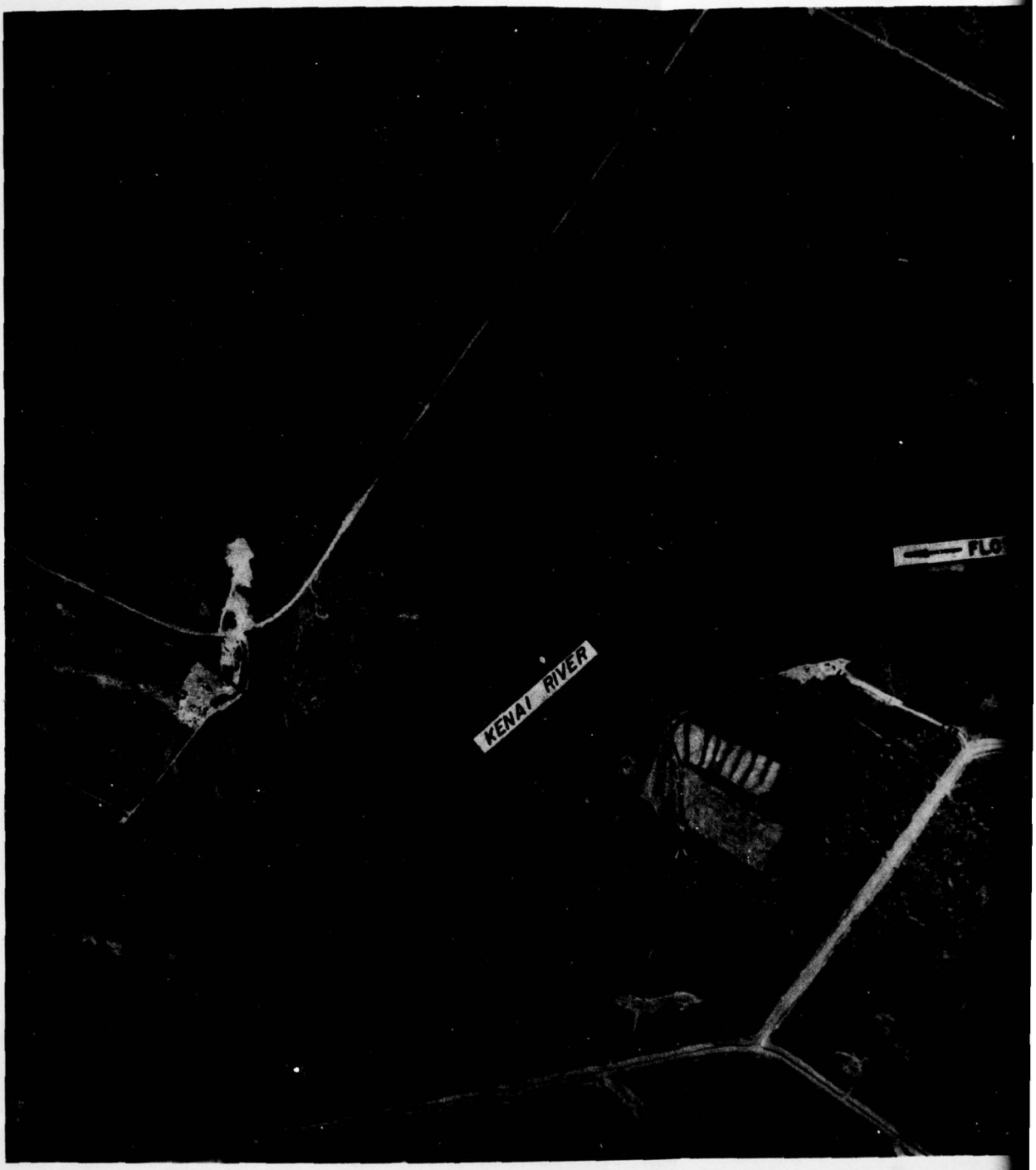
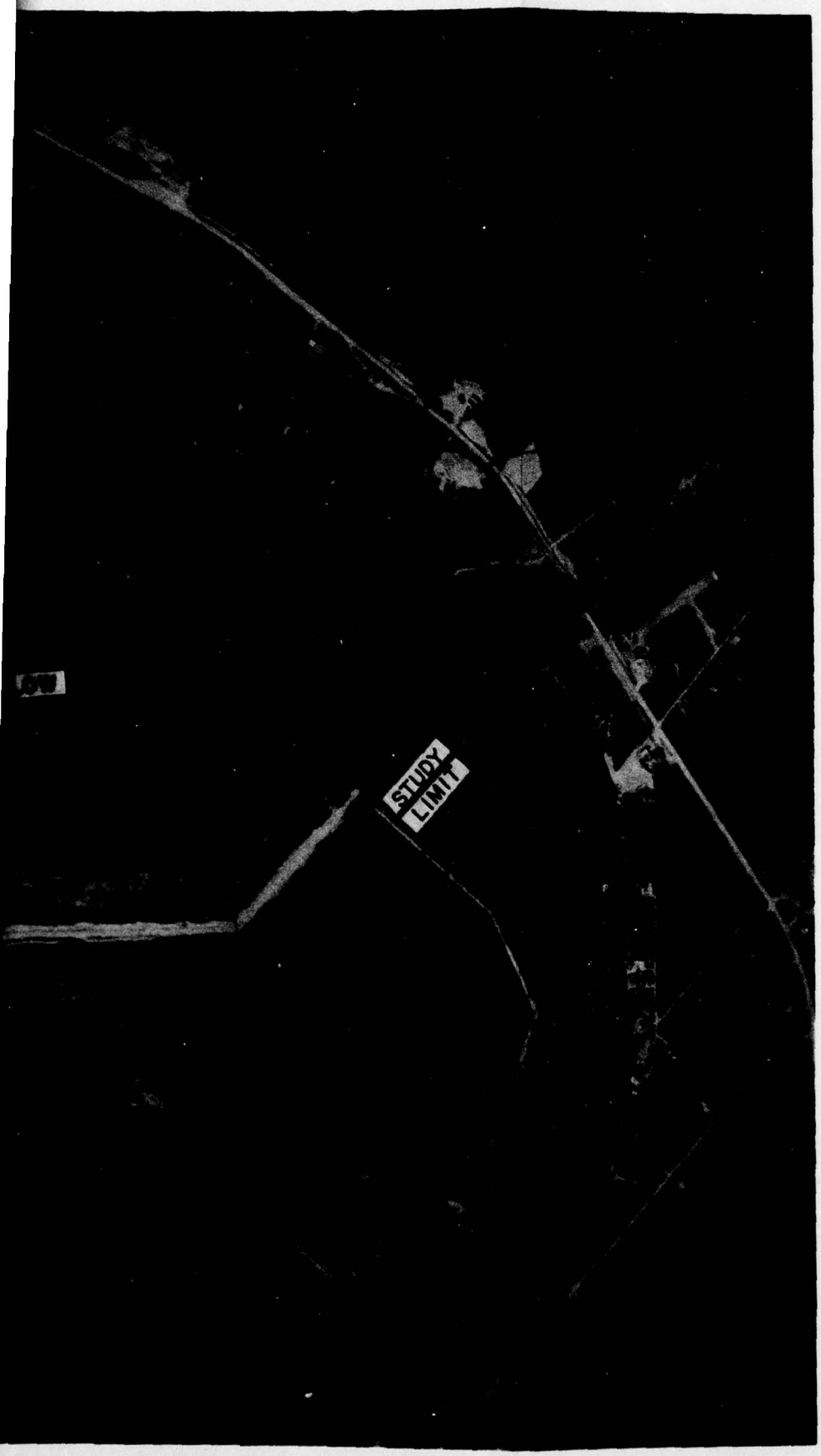
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA

JUNE 1973


KENAI RIVER

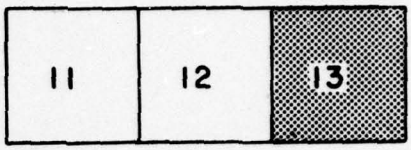


LEGEND

OVERFLOW LIMITS

STANDARD PROJECT FLOOD

INDEX MAP



NOTES

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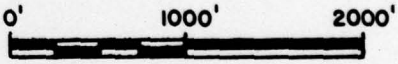

APPROXIMATE SCALE IN FEET

FLOODED AREA MAP
FLOOD PLAIN INFORMATION
KENAI RIVER
KENAI PENINSULA BOROUGH
ALASKA

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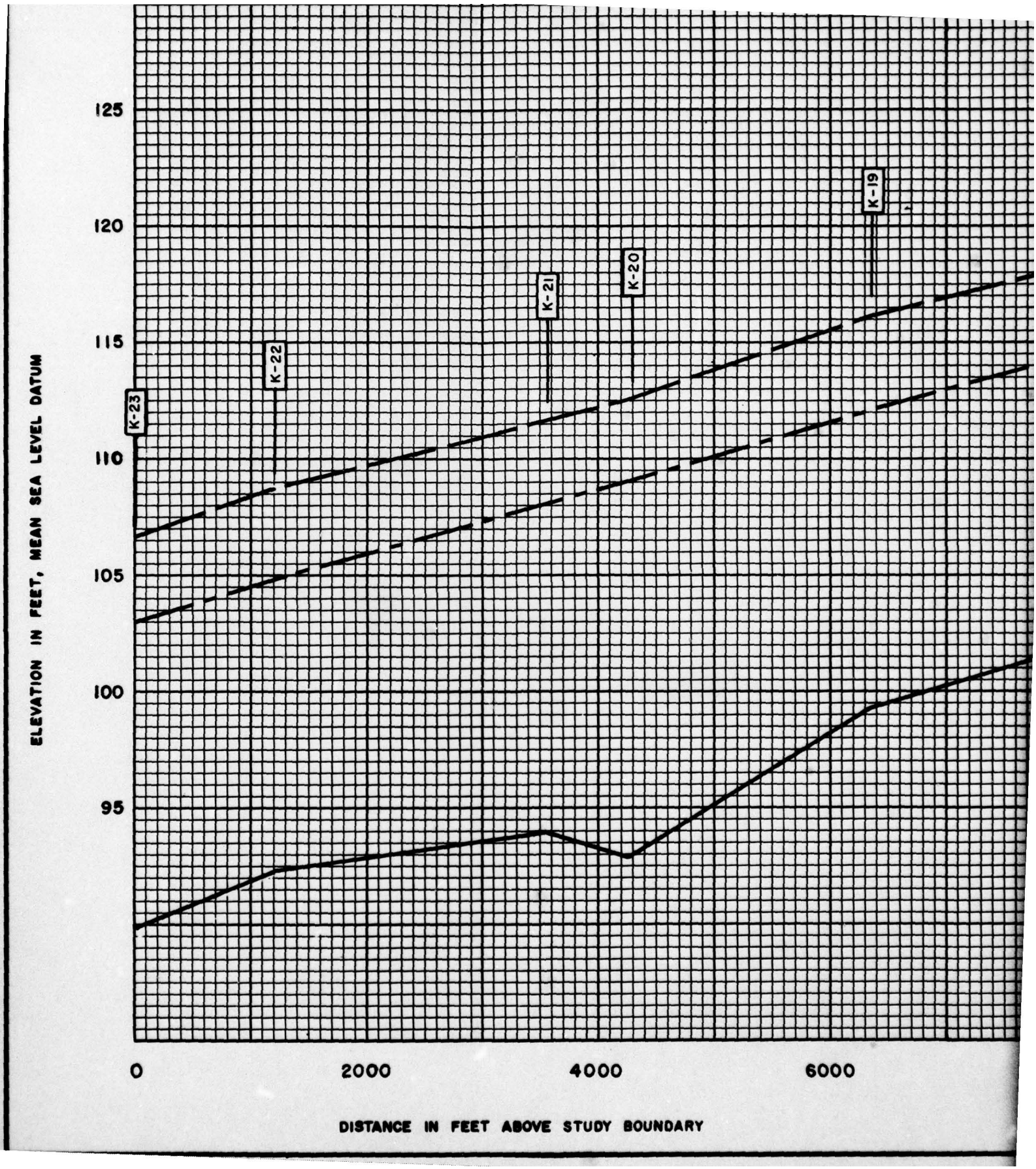
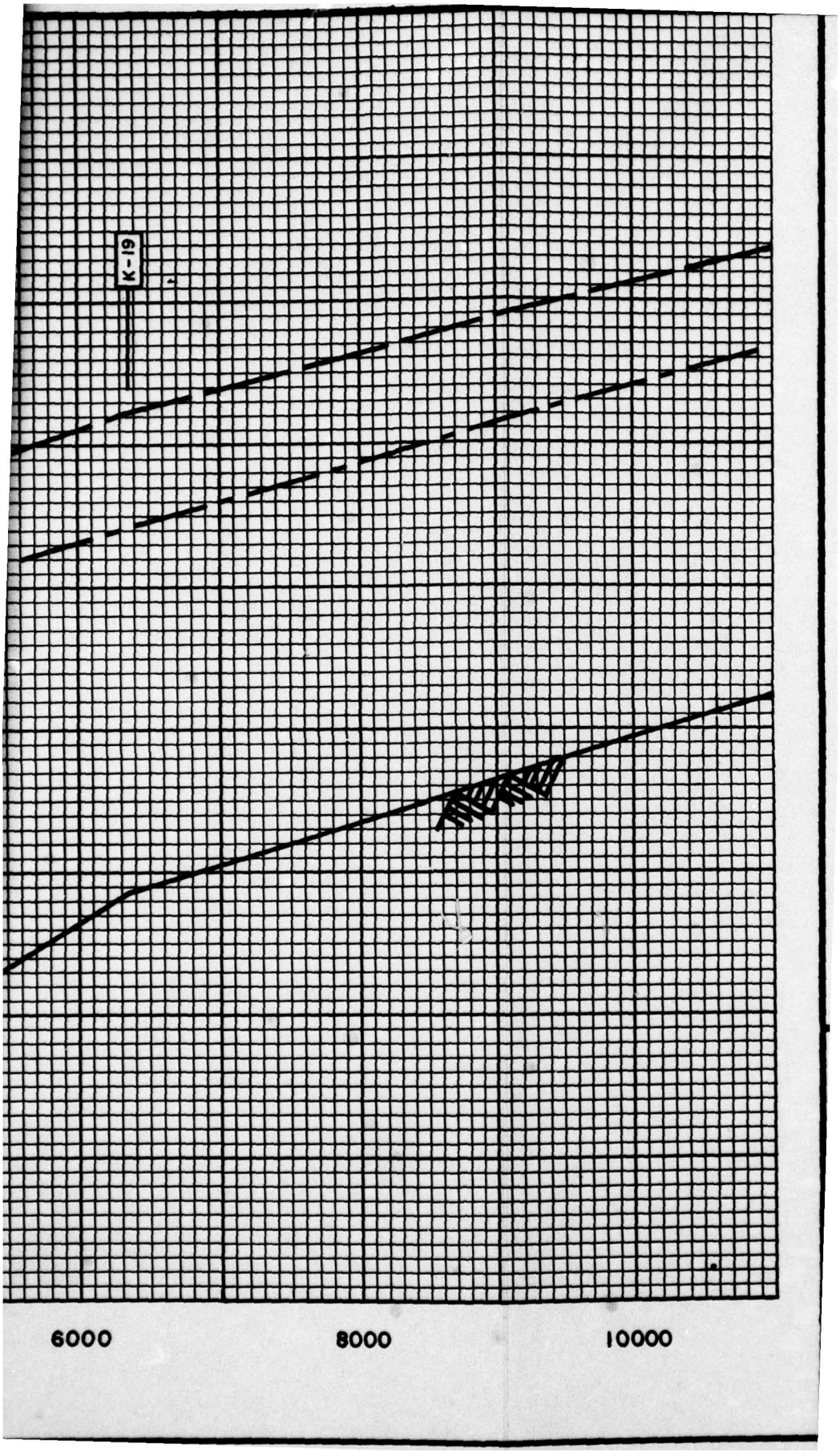
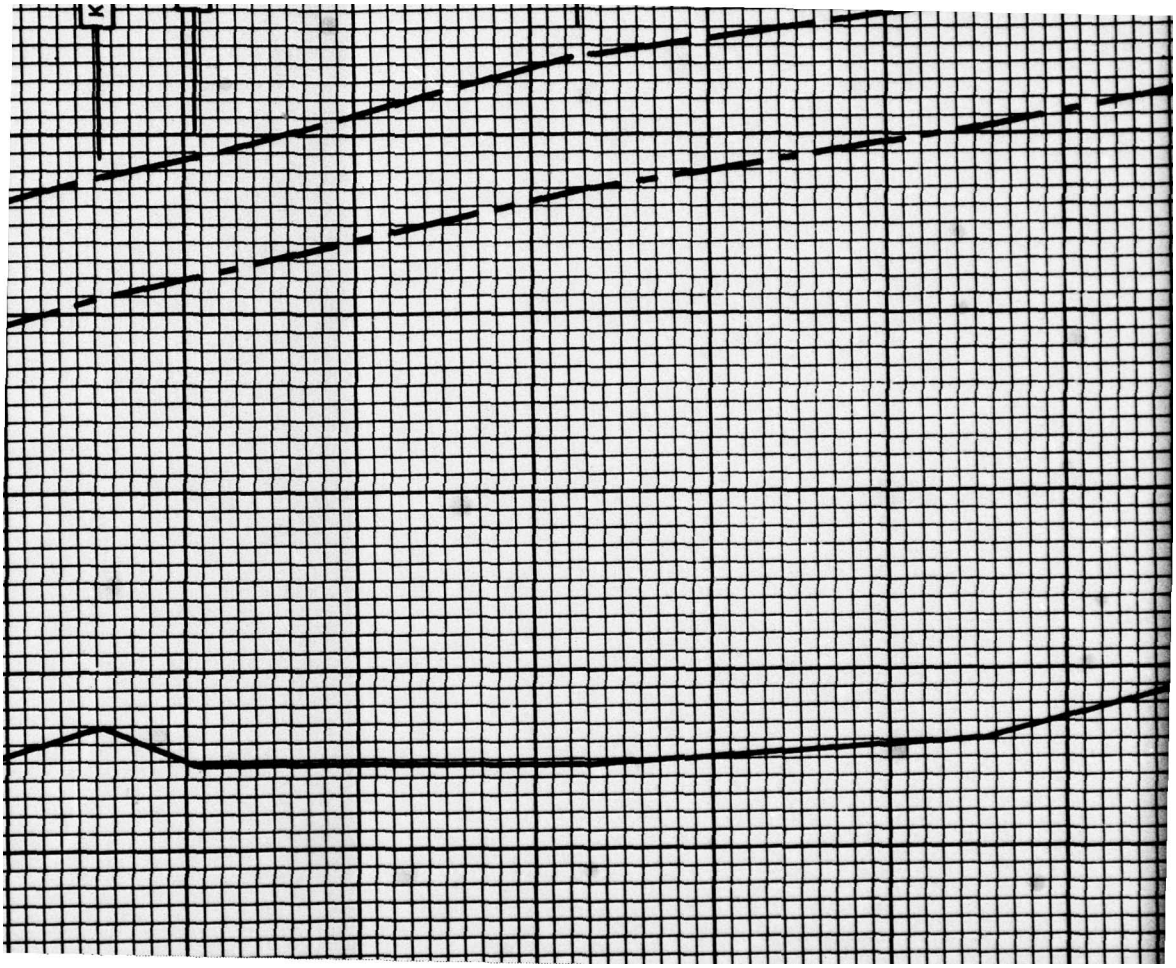
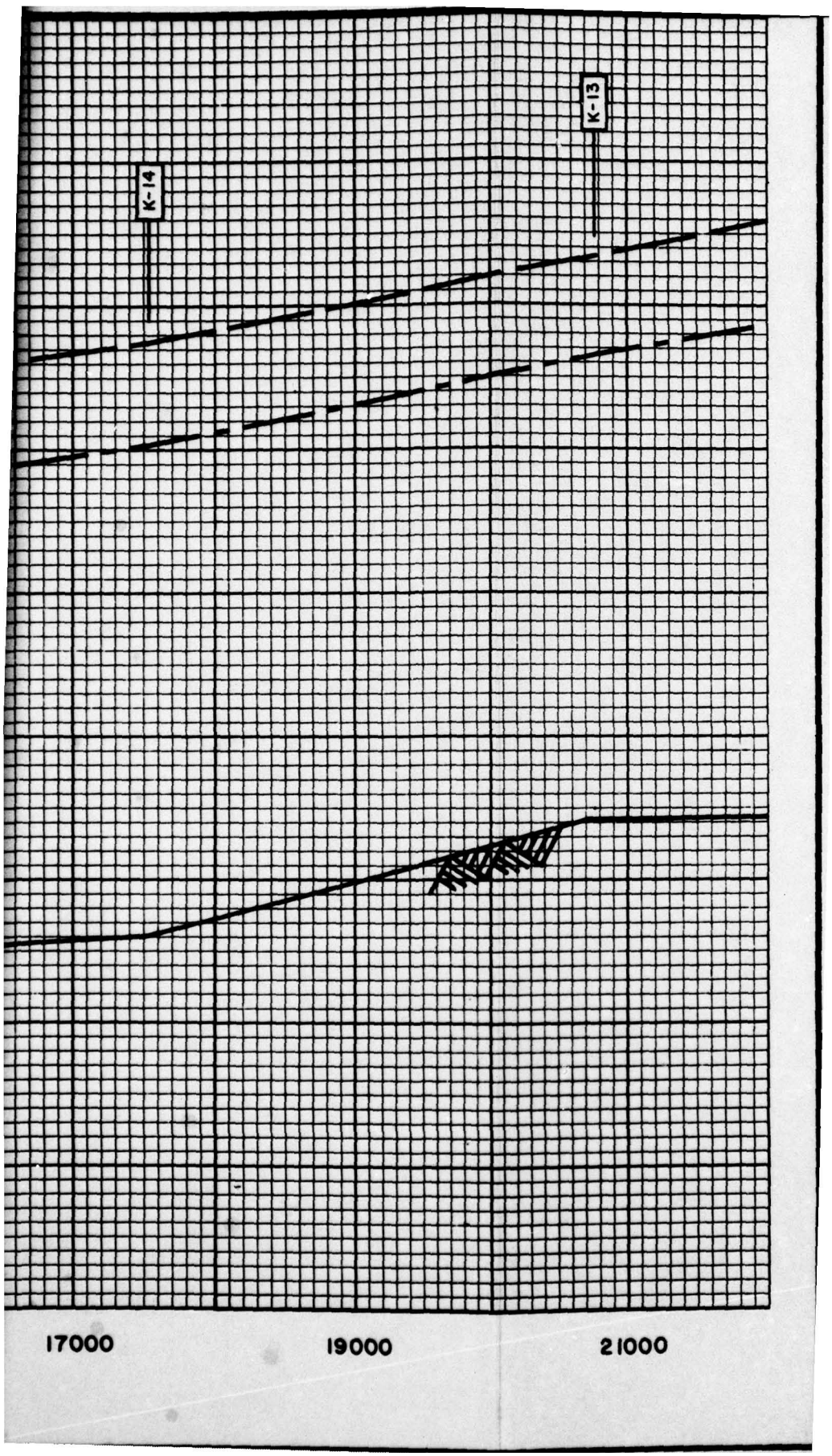
ANCHORAGE, ALASKA

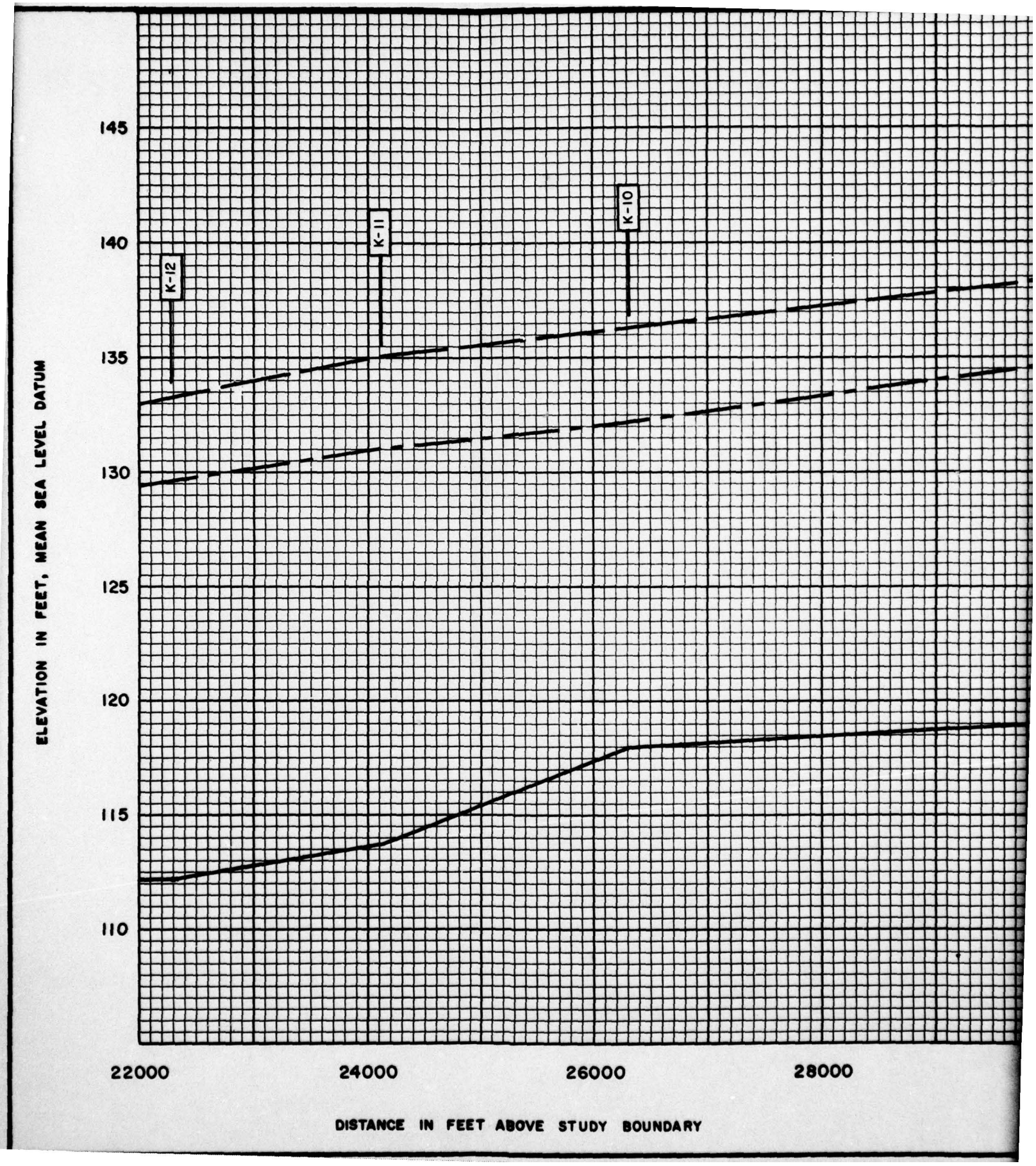
JUNE 1973

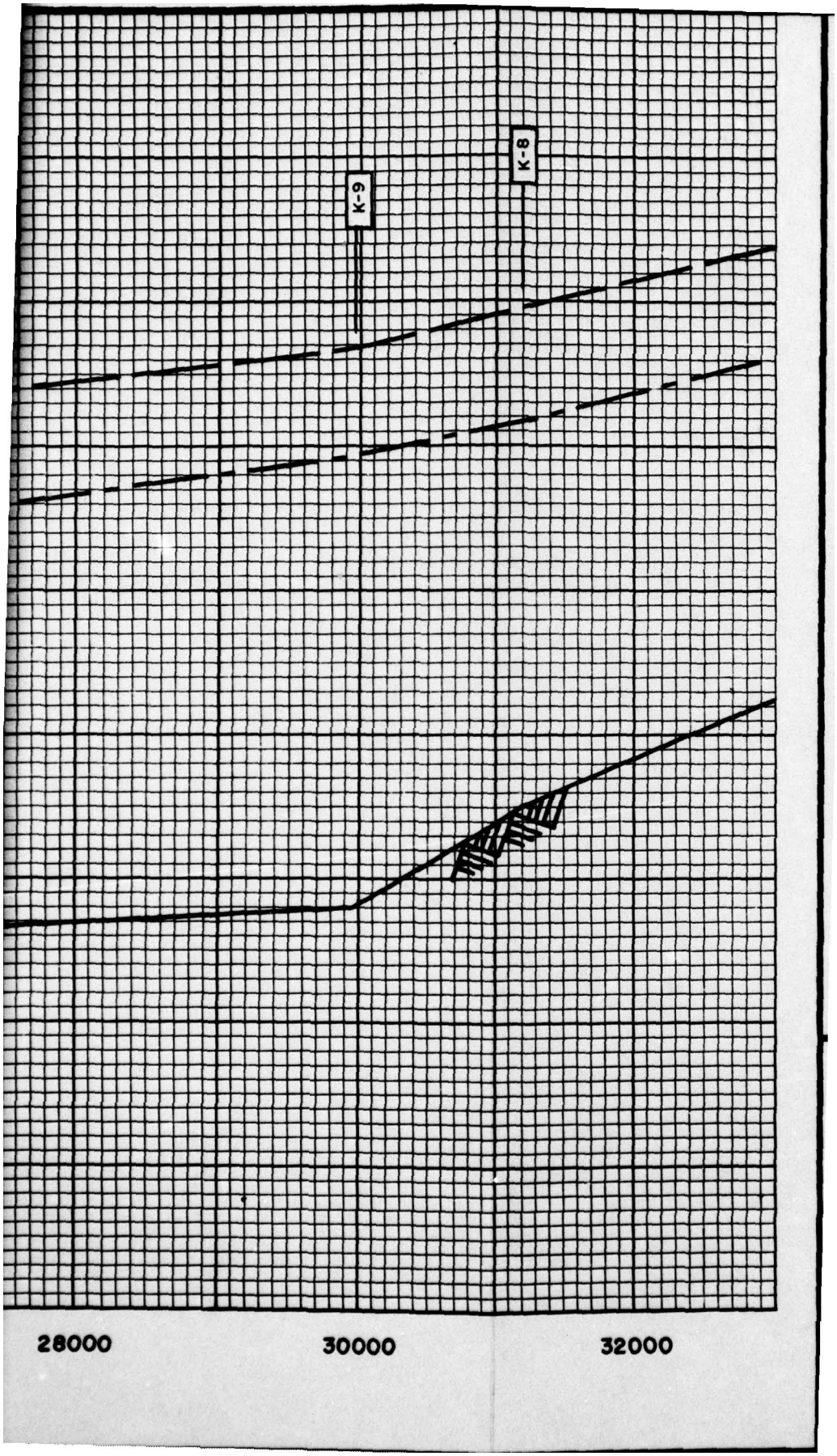

125
120
115
110
105
100
95
K-23
K-22
K-21
K-20
K-19
0
2000
4000
6000
ELEVATION IN FEET, MEAN SEA LEVEL DATUM
DISTANCE IN FEET ABOVE STUDY BOUNDARY

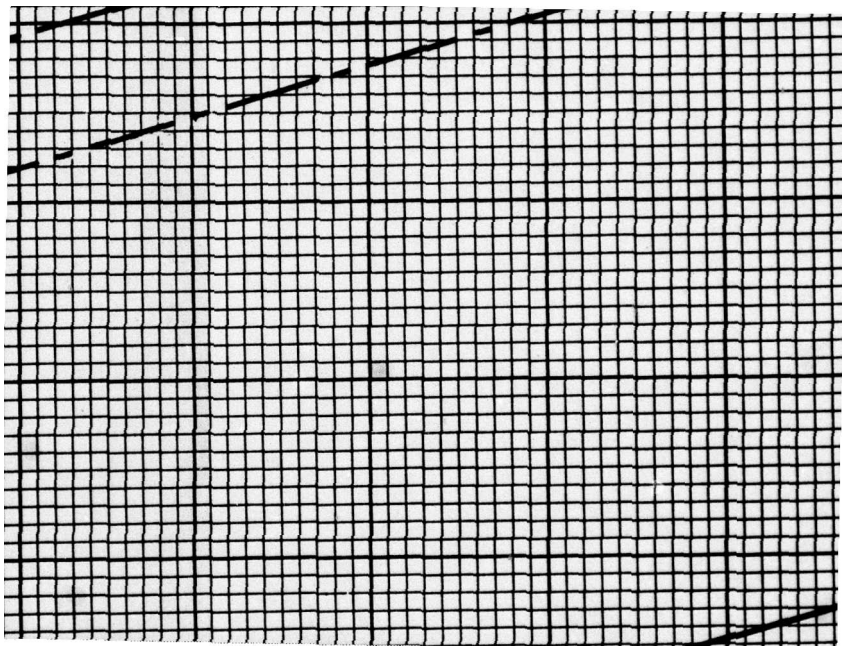

61-K
6000
8000
10000

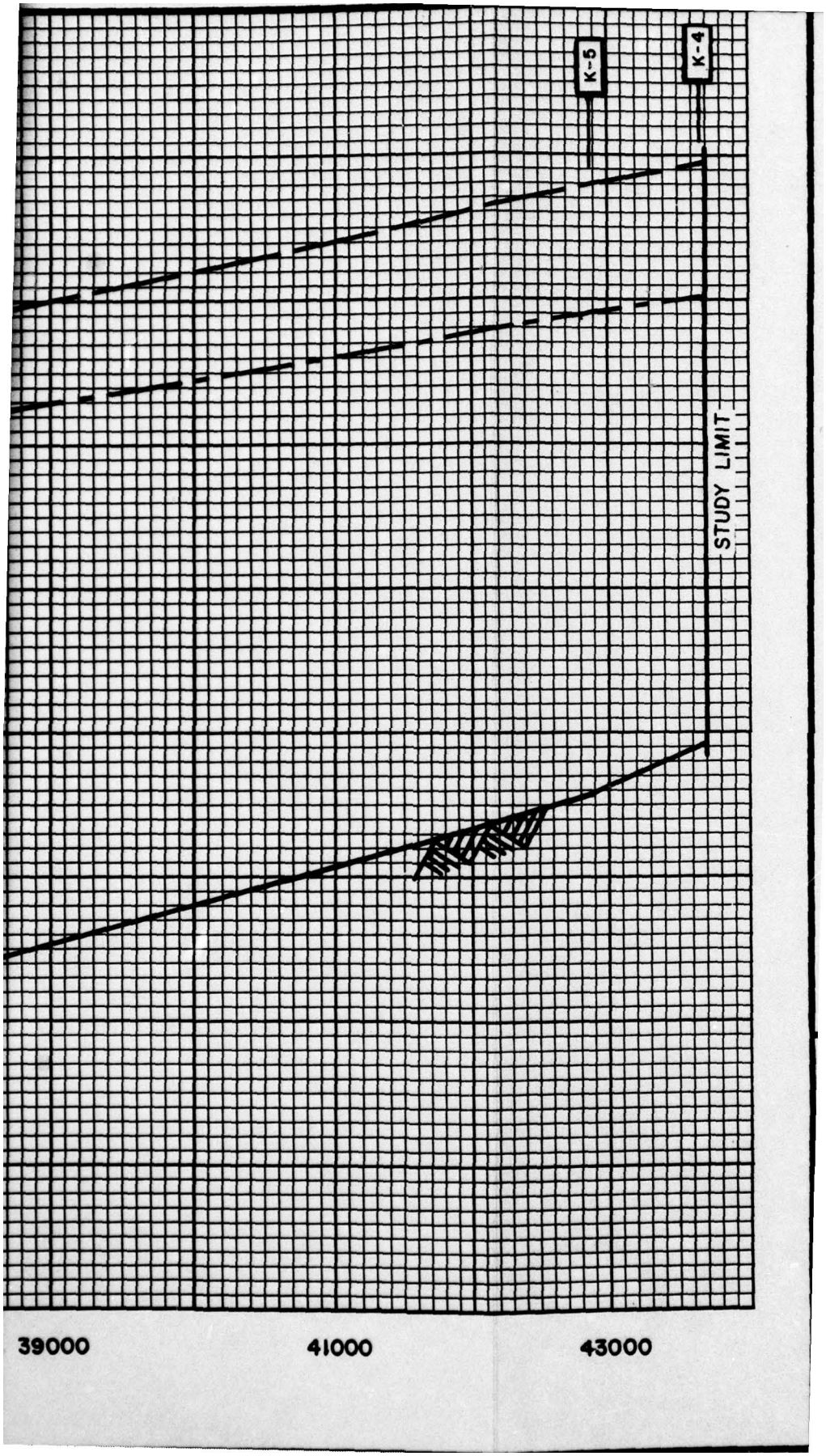


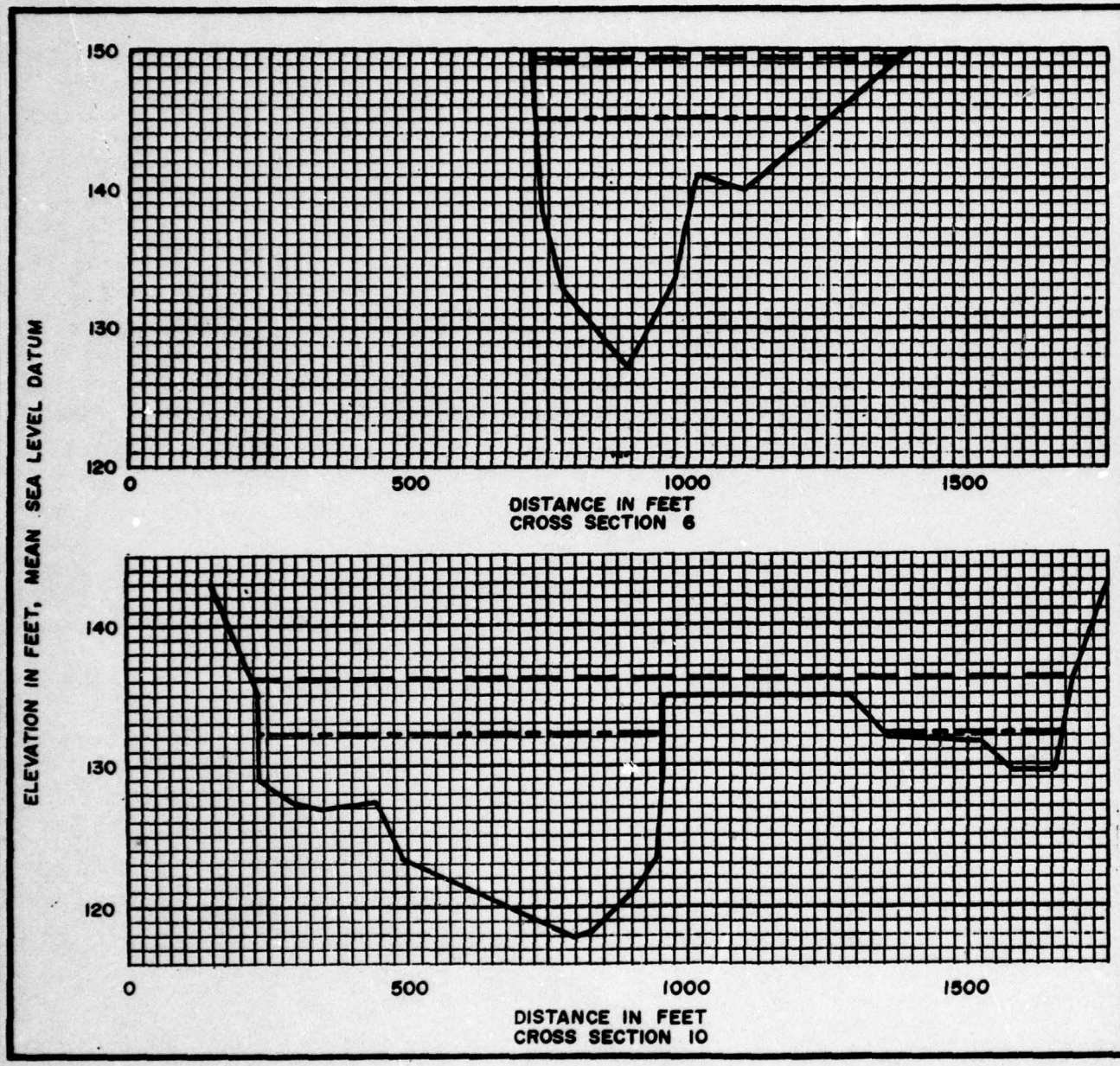

K-14
K-13
17000
19000
21000


145
140
135
130
125
120
115
110
K-12
K-11
K-10
ELEVATION IN FEET, MEAN SEA LEVEL DATUM
22000
24000
26000
28000
DISTANCE IN FEET ABOVE STUDY BOUNDARY


K-9
K-8
28000
30000
32000




K-5
K-4
STUDY LIMIT
39000
41000
43000



LEGEND

STANARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

NOTE

SECTIONS TAKEN LOOKING DOWN-STREAM. ADDITIONAL SECTIONS NOT SHOWN BUT AVAILABLE AT DISTRICT OFFICE.

SELECTED CROSS SECTIONS FLOOD PLAIN INFORMATION KENAI RIVER KENAI PENINSULA BOROUGH ALASKA

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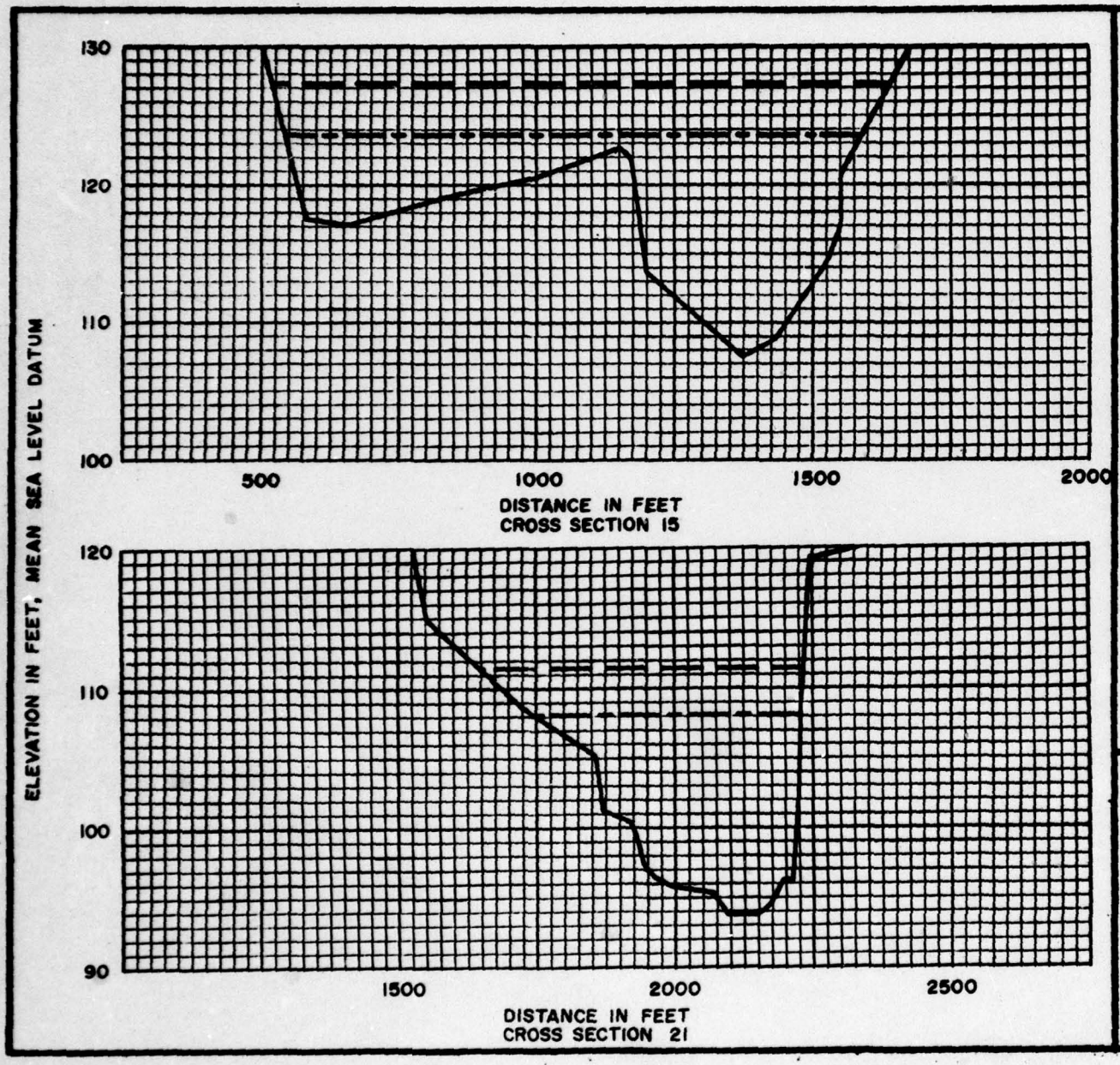
ANCHORAGE, ALASKA

JUNE 1973

PLATE 18



LEGEND

STANARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

NOTE

SECTIONS TAKEN LOOKING DOWN-STREAM. ADDITIONAL SECTIONS NOT SHOWN BUT AVAILABLE AT DISTRICT OFFICE.

SELECTED CROSS SECTIONS FLOOD PLAIN INFORMATION KENAI RIVER KENAI PENINSULA BOROUGH ALASKA

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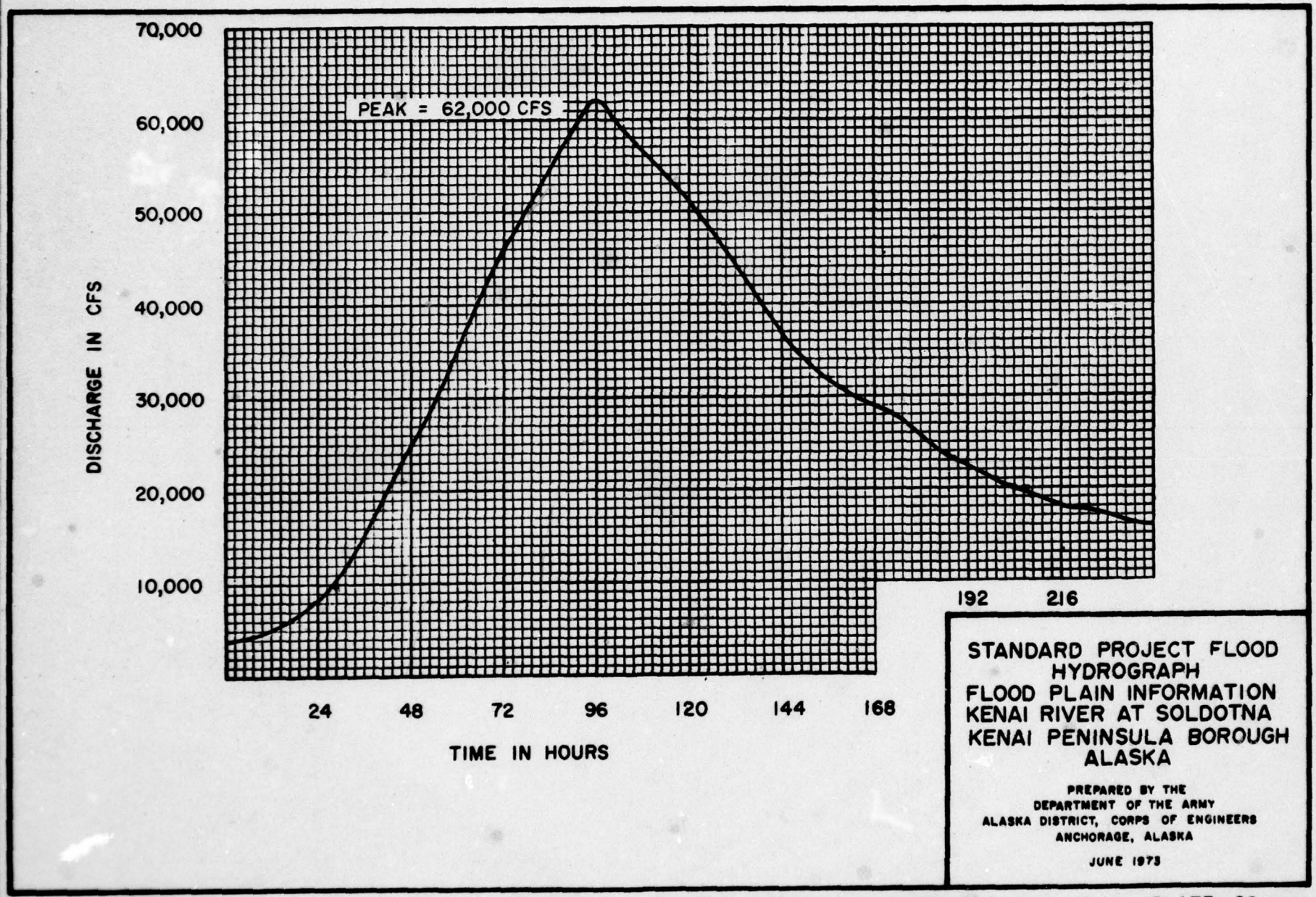
ANCHORAGE, ALASKA

JUNE 1973

PLATE 19



STANDARD PROJECT FLOOD HYDROGRAPH
FLOOD PLAIN INFORMATION
KENAI RIVER AT SOLDOTNA
KENAI PENINSULA BOROUGH
ALASKA

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JUNE 1973

PLATE 20